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Market Gardening,

BY

PROF. R. L. WATTS, Scalp Level, Pa.

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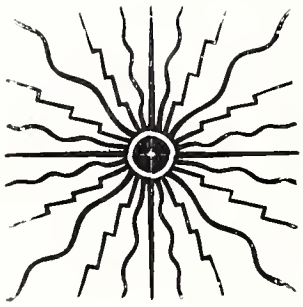

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PREFACE.

Commonwealth of Pennsylvania,
Department of Agriculture,
Harrisburg, Pa., May 12, 1906.

The competition into which the Pennsylvania farmer has been brought with the Great West, where farming is done on a much larger scale than it is possible for it to be done in the East, and where such staple products as wheat, corn, oats and hay can be produced much more cheaply than we can produce them in Pennsylvania, has led many farmers of this State to inquire whether there are other branches of agriculture to which they may turn their attention, and from which they may reasonably hope to derive better profits than can be secured by the old methods of raising grain, hay and live stock.

With our large and well established city markets and the constantly increasing local markets that are opening up all over the State, as the rapid development of our mineral resources is being pushed forward, there is a manifest disposition on the part of many, to cultivate less acres, and to give more attention to the production of such vegetables as find a ready sale at all seasons of the year. Many questions relating to Truck Farming, or Market Gardening, come to this Department. A number of inquiries are made concerning methods for constructing hotbeds, greenhouses, etc., while others relate to methods of soil preparation, planting, fertilization and cultivation.

In order, therefore, to meet an apparent want, the Department has had the following bulletin prepared by a gentleman whose education and practical experience enable him to speak with assurance upon the entire subject of Market Gardening.

We feel sure that the information it contains, will meet a want felt in many of the rural homes of the State, and it is sent out in the full belief that it will be welcomed by the people it is intended to benefit.

N. B. CRITCHFIELD,
Secretary of Agriculture.

LETTER OF TRANSMITTAL.

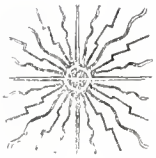
Scalp Level, Pa., April 30, 1906.

Hon. N. B. Critchfield, Secretary of Agriculture:

Sir: I have the honor of submitting to you the manuscript for a bulletin on "Market Gardening." It is the hope of the writer that the bulletin will be useful to tillers of the soil who desire to increase their profits by growing vegetables, which are more remunerative than general farm crops. We have endeavored to give instruction of a plain, practical character which can be followed by any careful, industrious farmer who wants to secure the largest possible returns from the soil cultivated. The notes are based on the experiences of leading market gardeners, as well as our own, and we believe the information can be applied safely in any locality affording favorable market inducements.

Yours respectfully,

R. L. WATTS.



MARKET GARDENING.

By PROF. R. L. WATTS, Scalp Level, Pa.

PENNSYLVANIA MARKETS.

When contemplating the cultivation of vegetables for commercial purposes, it is important to consider the cost of transportation to market, whether by rail or by wagon road, and also, whether the available markets usually pay good prices for garden crops. These questions are purely local. It is a fact, however, that the solution of the market problem is largely a matter of pluck and energy. There are thousands of farmers in our State who think they have poor markets; while the fact is that many who hold this opinion have golden opportunities to produce and sell garden crops. Pennsylvania affords some of the finest markets that can be found anywhere in the United States, and these markets are easily accessible. The State is a network of highways and railroads leading to all of our markets.

Western Pennsylvania is especially fortunate in possessing extra fine markets, but these markets are mostly supplied by other states. Scores of towns and cities in the western counties with populations varying from a few thousand to twenty-five thousand or more, receive the bulk of the garden crops consumed from the great distributing center of Pittsburg. We have frequently inquired of the farmers living near the smaller cities as to the number of tillers giving special attention to garden crops, and it is seldom that we find market gardeners or even farmers who make market gardening an important adjunct to their general farm operations. Immense quantities of vegetables are shipped from other states to our markets which might be profitably grown on adjacent farms, and we have found farmers in these same communities who claim that farming doesn't pay. Is it possible that hundreds and thousands of husbandmen in Pennsylvania are blind to their opportunity? Is it any wonder that the boys leave the farms and go to the cities, when so many farmers give all their attention to general farm crops which scarcely make enough clear profit to pay the taxes? There is need of a great awakening as to the most profitable crops to be grown on Pennsylvania farms. We recognize the fact that a large amount of general farming is desirable and necessary on most farms, but general farming should not be followed to the extent that we fail to supply our splendid markets with home productions of fruits and vegetables.

LOCATION.

In selecting a farm or location for gardening purposes, a large number of important questions should be carefully considered. Should this bulletin fall into the hands of a young man who expects to buy a farm to be devoted largely or exclusively to market gardening, we would advise him to spend plenty of time in searching

for a location. It is taken for granted, however, that most of the farmers who may be interested in this bulletin and who may have some inclination towards gardening, do not wish to vacate their farms and homes, and want to know whether existing conditions are favorable or might justify them embarking in any branch of the business. The more nearly the existing conditions of a location approach the ideal, the greater the possibilities for profitable operations.

Proximity to a large town or city, affording first class markets, is of first importance. The more remote the location from market the greater the cost of marketing. Teaming eight to twelve miles or more is expensive, and yet gardening, even at these distances from market, is frequently more profitable than general farming. It doesn't cost any more to haul a load of vegetables to market than a load of hay or wheat, and the profits are certainly in favor of the vegetables.

Being near town is an advantage for other reasons. It is less expensive to haul manures. It is not so difficult to procure the necessary help. It is easy to keep well posted concerning the market. Rough, hilly roads leading to the market may render the location undesirable.

There are fields or small areas on many farms which are well adapted to gardening, while most of the farm may be unfavorable. An acre here and there, planted in onions, celery or other vegetables, may bring more clear cash than entire fields of farm crops. For the production of early vegetables, the aspect or exposure is an important factor. Earlier truck can be produced on land with a southern or southeastern exposure. Locations not naturally protected by hills or woodland may be made warmer by the planting of hedges for windbreaks. The Norway spruce is excellent for this purpose. It is particularly important to have the cold frame and hotbed plat well protected from the north and west winds.

SOILS.

Any soil which produces satisfactory crops of wheat, corn and oats, will generally give good results when planted with vegetables. Some vegetables require special peculiarities of soil and do not thrive when planted in soils wanting in such properties. For example, it is impossible to grow first class carrots, salsify, radishes and other vegetables with long roots, in a soil containing much clay. These and many other vegetables thrive best in sandy soils, while cabbage, cauliflower and sweet corn prefer heavier soils.

The entire area of comparatively few farms can be profitably devoted to a general line of market gardening. Sandy bottoms along creeks and rivers are best adapted to a general line of gardening, while for specializing with such crops as cabbage, tomatoes and sweet corn, more elevated locations with heavier soils should be selected.

Sandy soils produce the earliest and smoothest vegetables and such soils are very easily tilled, yet they are extremely leachy and require liberal applications of manure to maintain productiveness. Distinctly gravelly soils, containing very little clay, should be avoided. Heavy, stiff, tenacious clays are not desirable for any

branch of gardening, although quite susceptible to permanent improvement. Reclaimed bogs and swamps are excellent, when properly handled, for the production of onions and celery.

There is another very large class of soils in the State which might be variously designated as loams, sandy loams, gravelly loams, gravelly clay loams, etc., many of which might be farmed very profitably in vegetables. It is a common belief among market gardeners, particularly those operating on sandy soils, that only sandy soils should be selected for gardening purposes. This is a wrong impression, except for those vegetables requiring soil in which sand predominates. A long list of vegetables, as potatoes, cabbage, tomatoes, sweet corn, beets, onions, celery, lettuce, cauliflower, peppers, turnips, etc., are grown to the highest state of perfection on various soils with practically no sand. In fact, there are thousands of acres of land in Pennsylvania, besides the sandy soils, on which a great variety of garden crops may be grown with entire success.

The matter of drainage is very important, for no soil, unless well drained either naturally or artificially, will yield satisfactory garden crops.

EQUIPMENT FOR RAISING EARLY VEGETABLE PLANTS.

A few early plants may be raised in the kitchen windows, but special equipment is required to grow a considerable number of plants. If the business is to be conducted on a large commercial scale, a greenhouse should be erected. It is generally conceded that plants may be started more conveniently, as well as more economically, in greenhouses than in hotbeds. Millions of good plants, however, are started annually in hotbeds, which are necessary in the absence of a greenhouse.

Cold frames are also essential. The common practice is to sow seeds of such vegetables as cabbage, cauliflower, celery, lettuce and tomatoes in hotbeds, transplanting when about one month old to cold frames.

A liberal supply of water is necessary when many plants are to be grown. Water may be applied with an ordinary watering can, but it is much more convenient and satisfactory to provide elevated tanks or reservoirs, piping the water to the greenhouse and frames, using a rubber hose and brass nozzle to water the plants. In addition to the equipment named, there should be rye straw mats in sufficient number to cover the sash of the hotbeds and cold frames; shallow plant boxes or flats to fill the hotbeds and cold frames and planting boards and dibbers to be used in transplanting.

GREENHOUSES.

It is not our purpose to enter into a discussion of details relating to the construction of greenhouses suitable for the raising of plants and the forcing of vegetables. We would not advise every gardener to build a greenhouse, for the investment would not pay unless operating on quite a large scale. On the other hand, we believe many gardeners in the State are making a mistake by not building and using greenhouses. The advantages of a greenhouse are many. It is more economical to furnish heat by fuel in the furnace than by manure in the hotbed. It is more convenient as well as com

fortable working in a greenhouse than stooping over a hotbed, with the additional discomfort, perhaps, of disagreeable weather. The soil and atmospheric conditions can be better controlled in a greenhouse, and consequently the possibilities of success are greater than with the hotbed. The air of the hotbed is liable to become very damp as well as too hot, and these two conditions may cause serious trouble by the damping off of plants. When the weather is cold and the winds severe it is difficult to properly ventilate hotbeds without chilling the plants. All of the points are in favor of the greenhouse, and yet the raising of only a few thousand plants every year would not justify the erection of a greenhouse. Gardeners located near a good home market where lettuce can be sold during the winter season are in a position to operate a greenhouse very profitably.

Fig. I shows a house constructed by the writer which has been entirely satisfactory for our purpose. As seen in the illustration, the benches are covered with a crop of Grand Rapids lettuce ready to harvest. The plants for the first crop of lettuce are placed on the bench in September, and there is time for growing a second crop before beginning to sow seed for early vegetables.

Those contemplating the erection of greenhouses should study the subject thoroughly before building. A few suggestions here may be of value:

Only material of first class quality should be used. It is never best to use sash bars or any other wood parts made of pine or native woods worked up by a planing mill in the neighborhood. Although the first cost may be less it will prove poor economy in the end. The best cedar or cypress should be used for all parts made of wood and the material furnished by firms who make a specialty of greenhouse building material.

The glass should be double strength A. Cheaper grades will be broken more in the winter by the freezing of water under the laps and the danger of loss from hail stones will be much greater. It is preferable to use the larger sizes as 16 x 24. There will be fewer sash bars, more light will be admitted and the house will present a better appearance.

The posts which support the house at the sides and ends may be made of various materials. It is most common to use either cypress or locust, both woods being very durable. Iron pipes are used sometimes, the lower ends imbedded in cement or concrete. The posts in our house, shown in the accompanying photograph, are composition cement and will last a lifetime or probably for centuries. These posts are soft enough to drive nails into and we can see no possible objection to their use. Angle irons connect the posts on the top and serve as supports to the lower ends of the roof bars. This method of construction requires fewer posts and there is less wood, which in time will rot. The house is braced with iron pipes. Mastica instead of putty and the largest size Peerless points were used in glazing.

The hot water system is much better than steam in heating small houses. With a good sized boiler and plenty of pipe the furnace needs no attention at night during the severest weather for a period of seven hours, and ordinarily the boiler requires no attention for eight hours or more and maintains a night temperature of 45 de-

FIG. 1.—Interior of greenhouse suitable for forcing lettuce and growing early vegetable plants.

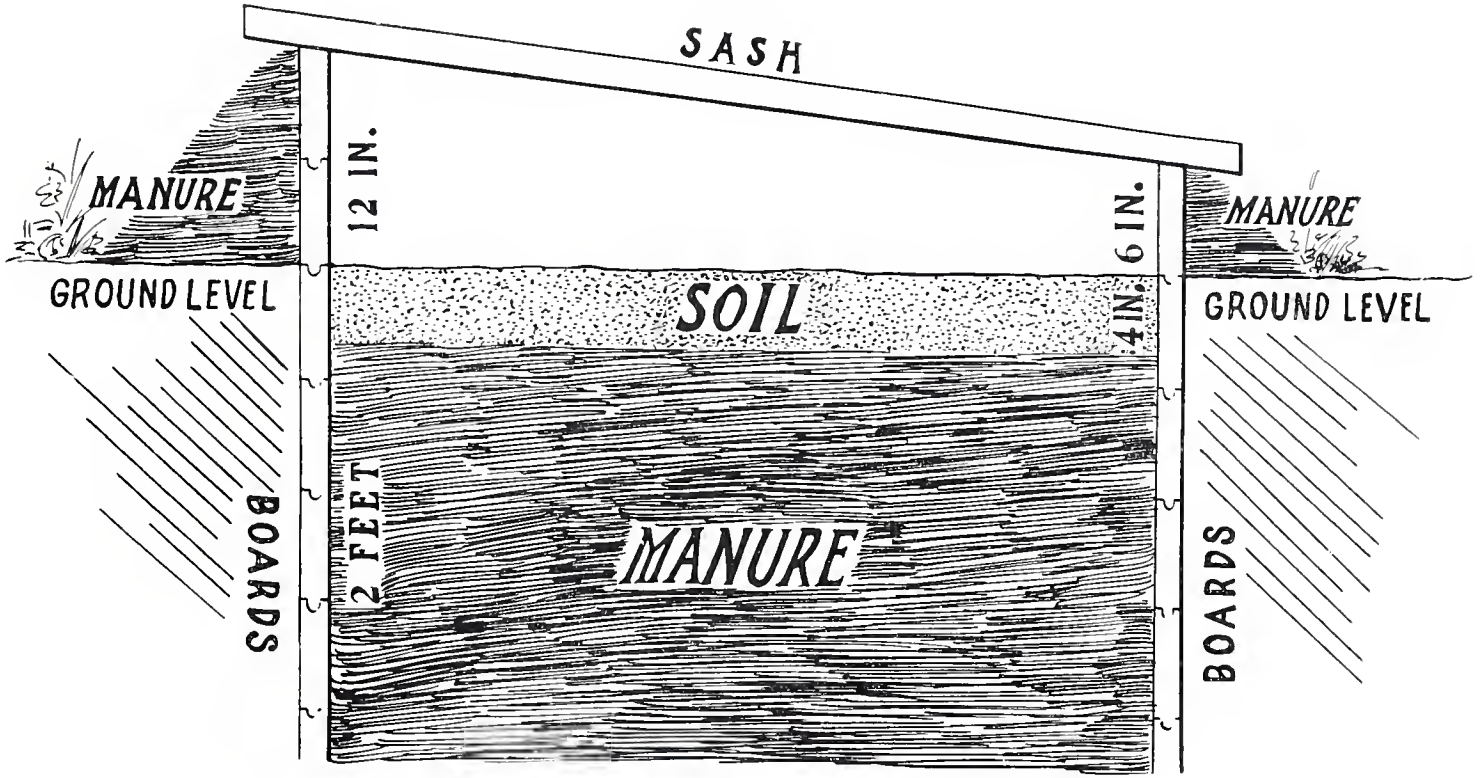


FIG. 2.—Hotbed showing method of construction.

grees, which is the proper temperature at night for the forcing of lettuce and the growing of such plants as cabbage, lettuce and cauliflower. It costs more to install a hot water system than steam, but the better service in small houses more than pays the extra expense.

THE CONSTRUCTION AND PREPARATION OF HOTBEDS.

The hotbeds should be located near an outbuilding which can be warmed and used for transplanting. It is also an advantage to have them near the water supply, unless the water is piped to the beds. A southern aspect is desirable and the frames should run east and west with the glass sloping to the south.

The pit for the hotbed should be dug in the fall before the ground is frozen to any considerable depth. It is not necessary in our State to excavate to a greater depth than thirty inches, and our practice has been to take out only two feet of soil. The pit should be six feet wide and long enough to accommodate the number of sash to be used. It should be lined with heavy boards, preferably chestnut, nailing to chestnut or locust stakes. If the ground is level, the frame should extend twelves inches above the surface of the soil on the upper side and six inches on the lower side. (See Fig. 2.) This will provide for the proper drainage of water from the sash. In making the frame, it is best to have two or three sash at hand so that no mistake will be made in the measurements. Cross bars or sash supports are placed three feet apart. Our practice is to use 2 x 3 chestnut for this purpose.

Fresh horse manure, containing a liberal amount of straw or other litter, is the best material to furnish heat in the hotbed. If manure is saved from the home stable, it should be collected and preserved under cover. It requires about one two-horse load for every two sash. When sufficient manure has been saved, or procured from livery stables, tramp compactly into piles about five feet square and three feet high. In three or four days, or less, considerable heat will be generated by fermentation and the manure should be tramped into another pile, throwing the outer portions into the center of the pile. When fermentation is well under way in the second pile, throw the manure into the pit in successive layers, tramping continuously. Fill the pit to within four or five inches of the top of the frame on the south side. The manure will settle several inches before time for sowing the seed. Place sash on the frame immediately after filling and plunge a thermometer in the heating material so that the bulb is four inches below the surface. The heat will rise rapidly until it reaches a temperature of, at least, 120 degrees. A high temperature may be maintained for a week or more, but it will not do to sow seed over such hot material. Wait until the temperature drops to 90 or 95 degrees, then place two or three inches of soil over the manure, if flats are to be used, or about four inches if the seed is to be sown in the soil placed directly on the manure. The outside of the hotbed frame should be banked with horse manure.

COLD FRAMES.

Cold frames are constructed in the same manner as hotbeds except that they are simply built on top of the ground and no manure is

used, heat being furnished by the rays of the sun. They are used for the wintering of such plants as cabbage and lettuce, and also for forwarding plants in the spring after they have been started in the hotbed or greenhouse. The ground should be graded level before making the frame. This is important to prevent water from draining off the soil or plant boxes. In recent years our practice has been to use all chestnut lumber for the frames because of the durability of this wood. The posts or stakes should be not less than 2x3, cross bars the same size, and all boards used about one and one-fourth inches thick. Boards one foot wide are used on the upper side and boards nine or ten inches wide on the lower side of the frames. The stakes to which the boards are nailed should be driven not less than six feet apart. Blocks are sawed out of the sideboards three feet apart so that the cross bars fit neatly and are even with the top of the frame. The distance from center to center of cross bars or supports should be half an inch more than three feet so that the sash can be moved freely without binding. An excellent plan is to nail half-inch strips down the center of the cross bars and these will prevent binding when the sash are moved. The distances between cross supports and the placing of these strips can best be regulated by having two or three sash at hand while the frame is being made.

When there are several frames, it is best to allow about ten feet space between them so there will be plenty of room to handle the sash and mats, ample space for driving through with the wagon and for piling snow after heavy falls as in March of this year. Fig. 3 shows some of the frames in use on the writer's farm.

SASH FOR HOTBEDS AND COLD FRAMES.

It is more convenient to use sash which are not very large. We have in use four hundred 3x6 feet sash and we believe a larger size would be of no advantage, but rather a disadvantage on account of increased bulk and weight. Some gardeners procure sash one and three-fourths or even two inches thick. These are more durable but are heavy to handle. Our preference for thickness is one and three-eighths inches.

The very best material should be used in the manufacture of sash. A common mistake of beginners is to buy sash from home planing mills using pine or other woods less durable. The best material is cedar or cypress and it is always better to procure the sash from a factory which makes a specialty of hotbed sash and greenhouse building materials. Another matter which should receive attention is to require that the joints be well painted with oil and white lead before the sash are put together.

If quite a number of sash are to be used it is more economical to do the glazing at home. Paint the sash before glazing, using a liberal supply of oil in the white lead. After the paint is dry the glazing may be begun. It is best to procure single strength A glass rather than cheaper grades on account of less breakage in handling sash and by the freezing of water between the laps. If the sash are 3x6 feet in size there should be three runs of 10x12 glass, each run requiring six panes or eighteen panes per sash. The work of glazing can be done most conveniently if the sash is placed horizon-

FIG. 3.—Some cold frames in use on the writer's farm.

FIG. 4.—A cabbage plant removed from flat, showing compost attached to the roots.

tally on two boxes or supports of the proper height and then place the glass in the entire sash, overlapping the panes about one-fourth inch. Secure the glass at each lap by special glazing points as the "Peerless," using the smallest size manufactured, which will hold the glass in place and prevent them from sliding down the sash when in use on the frames. After driving in the glazing points, apply putty with knife or bulb, or better still, use mastica. This latter material may be purchased through dealers of greenhouse material and is vastly superior to putty. The material costs $1.25 per gallon and is applied with a small machine costing 75 cents. It adheres to the wood much better than putty and is far more lasting. After the mastica is somewhat hardened, another coat of paint will render the sash more durable.

When not in use, the sash should be stored in the dry, stacking horizontally and covering the top sash with boards to prevent breakage by accident. If the sash are stored when not in use and painted every two or three years, and repaired when necessary they will last many years.

FLATS OR PLANT BOXES.

Plants are frequently raised by sowing seed in the soil placed directly on the manure in the hotbed then transplanting into rich soil in the cold frame. Although this method is employed successfully by many gardeners, experience has taught that it is more convenient and satisfactory, unless a greenhouse is available, to sow the seed in flats or shallow plant boxes, transplanting into the same kind of boxes. The weather is often very severe at the time the seed should be sown in the hotbed, but if flats are used the work may be done in a warm outbuilding, watering there if more convenient, and then place the boxes in the hotbed. When the time for transplanting arrives, the flats of plants may be carried to a warm, pleasant room, provided with tables or benches, and the work of transplanting done with ease and comfort. It is often cold, wet and disagreeable when early plants should be transplanted into the cold frames and it would be quite impossible to work advantageously in the open air under such unfavorable conditions. When flats are used, a large number may be planted, set back on the floor or shelves, and, if the weather is cold, the planted boxes can be hurried to the frames where they may be quickly covered with the sash, and mats, too, if necessary. When the plants are ready for the garden or field, the boxes can be watered thoroughly, loaded on the wagon, and hauled to the field where they should be distributed at convenient intervals. By standing flats on end and jarring lightly, the compost will separate from the bottom and sides of the flat, the hand can be slipped under the layer and plants removed by breaking the compost which has become a network of fine roots, thus taking out each plant with considerable compost attached to the roots. (See Fig. 4.) This is a most important matter in transplanting early vegetable plants When all the foregoing advantages are considered, it seems to the writer that no one should attempt to grow early vegetable plants without the use of flats. We consider them so important that we use about three thousand flats or a sufficient number for four hundred sash.

It is an advantage to make the flats uniform in size and of such dimensions that no space is lost in the hotbeds or cold frames. It is very convenient to make flats so that four may be placed side by side in the frame without loss of space.

There are different ways of procuring these flats. The past season we cut chestnut logs from second grade timber, and had them sawed into half-inch stuff which was used for the sides and bottoms, and some three-fourth inch boards for the end pieces. By means of a small engine and circular saws in our farm shop the lumber was soon cut into the required sizes, thus making all the flats of uniform dimensions. Any kind of inferior lumber, not desirable for other purposes, may be used in making flats. Another plan, is to rip small boxes, as those in which canned tomatoes and soaps have been shipped. These boxes may be ripped with a handsaw or a small circular saw into sections two inches deep. We have used flats of greater depths, but with no better results in any way. In fact, the heavy weight of the deep boxes when filled with soil or compost renders them very objectionable. Bottoms may be procured for the sections of soap and tomato boxes from boot and shoe or dry goods boxes of half-inch lumber. If large boxes can be bought at reasonable prices, it will pay to make flats of uniform size. The most economical plan, however, so far as the cost of flats is concerned, is to rip small boxes as described, although this plan is objectionable because it necessitates the loss of space in the frames.

TRANSPLANTING BOARDS, NOZZLES, ETC.

In the transplanting of seedlings into flats we have found boards as illustrated in Fig. 5, to be of great advantage. These boards are made of sound lumber cleated at the ends with strips. The board should be large enough to cover the largest flats. Holes are bored at the required distances with a three-quarter inch bit. For cabbage, lettuce and cauliflower the holes should be about one and one-half inches apart. The holes in the board for tomato plants, first transplanting, should be two inches apart. For instructions on the use of planting boards, see notes on "Raising Early Vegetable Plants" on page 11.

The labor involved in the care of plants must be reduced to a minimum. A rubber hose attached to a pipe line connecting with a tank or reservoir is a great advantage in watering. It pays to get three-quarter inch hose of the best quality. A brass rose nozzle, as shown in Fig. 6, with a four-inch face, attached to the hose, should be used to distribute the water evenly over the soil or plants. If the delivery is not rapid enough, enlarge the holes in the nozzle with the point of an awl or small file. Another very useful device is a brass hose mender, also shown in Fig. 6. Whenever a hose begins leaking at any point, cut out a small section containing the defect, force the mender into each end of the severed hose and the union is complete. We believe this is the most satisfactory hose mender on the market. The nozzles and hose menders, which are illustrated, may be procured from seedsmen in Philadelphia and New York.

STRAW MATS TO PROTECT PLANTS.

Cabbage, cauliflower and lettuce plants intended for early crops are usually started the latter part of January or early in Feb-

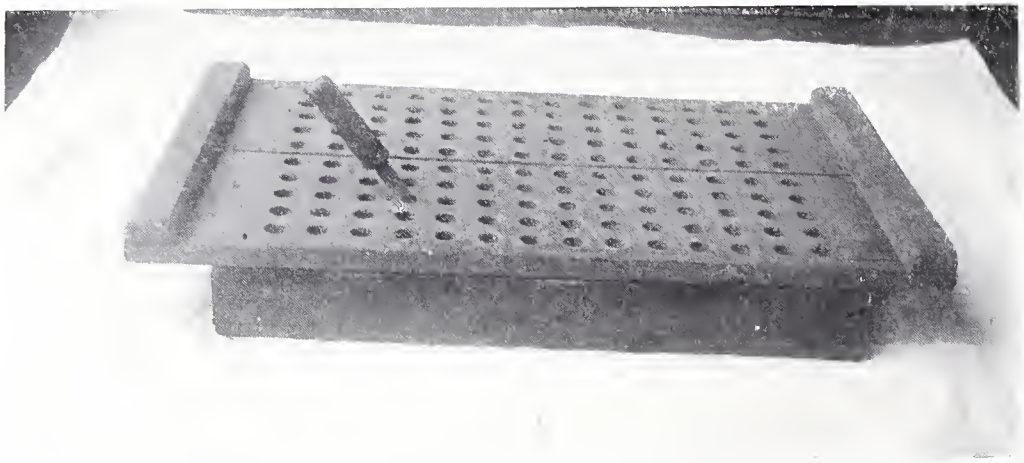


FIG. 5.—Transplanting board placed on flat.

FIG. 6.—Brass rose nozzle on left; hose mender on right.

ruary, and the plants are ready to place in the cold frame soon after the first of March. At this season of the year the cold nights would be destructive to the plants if given no other protection than the sash. Some gardeners rely mainly on wooden shutters, but these are not so warm as mats and cannot be placed on the frames or be removed so rapidly.

Mats of various materials, as burlap or rubber cloth packed with cotton or waste material, have been placed on the market by dealers, but market gardeners can make mats from rye straw just as serviceable at much less cost. They can be made on rainy days or through the winter when the gardener is not usually very busy.

It is best to grow rye straw, especially for the purpose, in soil well enriched so that the straw will be as long as possible. Cut the rye before it is very ripe as the straw will be much tougher than when cut in an over-ripe condition. After flailing, the straw should be piled in large bundles and stored over the barn floor where the rats and mice will not likely be so destructive as in mows.

The mats are made on a frame as shown in Fig. 7, which also illustrates a mat in course of construction. This frame is exactly 6 feet by 6 and one-half feet in size, outside measurement. The mat is intended to cover two sash and the extra half-foot is to lap over the ends of the sash to prevent the air and wind from entering the frame between the sash and sideboards. If the mats are more or less than six feet in width there will be trouble in handling them. They get very heavy when soaked by rains and should be shifted in the easiest possible way. To cover sash, step on the mat, reach behind, clasping the mat at two places where tied by the cords and walk across the frame on the sides of two sash immediately above a cross bar, drawing the mat over both sash. By a little practice, the mats can be dropped to place without much further attention. In removing water soaked mats, walk below the frames, throw back the lower ends of the mats as far as convenient, then walk along the upper side and draw them off. If the mats are dry they may be pulled off from the upper side without overlapping as when wet.

Fig. 7 shows a mat in course of construction and the essential points of the frame on which the mats are made. It will be seen that there are seven pegs at one end of the frame to which the same number of cords is tied with bowknots. At the other end is a 2x3 cross bar running across the frame in which are seven pegs holding the cords at this end of the frame. The cross bar is held at each end by a bolt or pin extending through the sides of the frame. The frame is supported by legs of convenient height and the mat is begun at the end opposite the cross bar. When about two feet of the mat is made and the reach is too far to work with comfort, remove the pins holding the cross bar in place, shove it along the frame eighteen inches or two feet and secure again by the two pins running into other holes bored in the frame.

Before beginning work on the mat, stretch the horizontal cords tightly. Care should be exercised in getting the strongest tar rope for this purpose. Then tie on each peg opposite the cross bar, a five or six foot piece of the same quality of tar rope. Place two bundles of rye straw, each containing about twenty-five haulms on the horizontal cords, close to the pegs, the tops overlapping in the middle,

using additional straw in the middle if necessary. Pass the second lot of cords over the rye and under the horizontal cords, making half knots and with a quick movement draw tightly. Place other bundles of straw on the horizontal cords and proceed as before until the mat is complete. It is important to tie cords securely at the ends of the mats. As the work progresses, trim the sides of the mats with clippers or sharp butcher knife. When not in use these mats should be stored where rats and mice cannot damage them. Mats properly cared for will last several years. They are indispensable in the growing of many plants.

GROWING EARLY VEGETABLE PLANTS.

In the production of early vegetables it is very important to have strong thrifty plants ready for the field the first day it is safe to transplant. A delay of a few days, when all conditions are favorable for planting, is a serious mistake and may be the cause of reaching the market too late to catch the highest prices.

In growing early vegetables which require glass to start the plants, more depends upon securing the right kind of plants at the right time than upon any other factor and this question should be carefully studied by every gardener. Additional notes on the growing of early plants will be found in the directions given for the culture of each particular vegetable.

The strength and vigor of a plant is largely dependent upon the character of the seed used. Old seeds are generally slower to germinate and frequently produce weak plants. It is always safer to use new seed, and it is also important to procure large, plump seeds. To avoid trouble and disappointment, it is desirable to purchase seed not later than January 1, and to test carefully before making the main sowing. In the absence of hotbeds at this season of the year, and if no greenhouse is available, the test can be made in the kitchen window. Count two lots of 100 seeds of each variety to be grown, sow in separate rows in a cigar box or other shallow box, and count the plants that come up. This is a more certain and practical test than by sprouting the seeds between damp cloths or by other methods.

Preparation should be made the previous fall by storing away soil to be used in starting the plants. Any good garden or field loam, as free as possible from weed seeds, should be selected for this work. Loams in which there is little or no clay are the best, as such soils will not bake to any considerable extent.

If a greenhouse is available, it is best to sow in drills on the bench. If a hotbed is to be used it is more convenient to sow in drills in shallow plant boxes. After filling the boxes, press the soil firmly, especially in the corner and along the sides. With a narrow straight edge, as a piece of plastering lath, make furrows about two inches apart and one-fourth to three-eighths of an inch deep. The seed may be sown broadcast, covering one-fourth inch, but our preference is to sow in drills. The plants come up better and are more convenient to lift at the time of transplanting. After sowing, cover the seed or close the furrows, firm the soil with a wooden block, and water thoroughly. The watering may be done either before or after setting the flats in the hotbed.

FIG. 7.—Rye straw mat in course of construction.

Beginners are often perplexed as to how thickly to sow the seed. This matter can be better regulated by sowing in drills than when broadcasting. A flat made from an ordinary soap box is large enough to grow seven or eight hundred plants or even more when there are no mishaps. In sowing cabbage, lettuce, pepper, tomato, egg plant, etc., from twelve to fifteen seeds per each inch of furrow is about right. If the furrows are of uniform length the seeds may be counted for one furrow and a small measure devised (as a thimble partly filled with parafin) to sow about the same quantity of seed in each furrow. After sowing the seed the furrows are filled rapidly by moving a straight edge over the ridges. If the seedlings seem to crowd too much, thin them out as soon as possible, press the soil about the remaining plants, and then water enough to settle the ground.

Three conditions are necessary for germination, namely: Air, heat and moisture. So far as the requirements of germination are concerned, no attention need be given to the question of air. Heat and moisture must be carefully regulated and controlled. The plant grower should always bear in mind that a high temperature and excessive moisture, with little ventilation, necessarily produce weak, spindling plants. Every possible effort should be made to maintain a moderate temperature in the greenhouse or hotbed, and it is important not to water more than absolutely necessary. In the management of hotbeds, ventilation should be attended to daily, watering only when the ground looks dry or when the wilted or dwarfed appearance of the plants indicates the need of water.

The manure should be placed in the hotbed at least ten days before the date on which it is desired to sow. (For time of sowing see notes on different vegetables.)

In about four weeks the seedlings are usually ready to transplant. By this time the rough leaves will be formed and a good root system developed. Our practice is to make a compost of about half manure and half soil and the addition of some bone meal. A shovelful of rotten manure is first placed in the bottom of the flat and then almost filled with the compost. A thin layer of fine soil is placed on top of the compost in the flat, packing the compost as well as the layer of soil on top, making the flat level full and soil quite firm. The flat is now ready to plant.

The planting board shown in Fig. 5, is placed over the flat, resting on a box or table of convenient height. Place the left hand on the planting board, holding it firmly and with the right hand and dibber, shown in Fig. 5 (the dibber should work freely), punch the holes in the soil ready to receive the plants. If the soil contains just the right amount of moisture, which can be regulated by sprinkling if necessary, and mixing before placing on top of the compost, no trouble will be encountered in making the holes or in transplanting. One boy will punch the holes as fast as six or eight can plant. After punching the holes, the flats are set carefully on the working-table, and small boys drop a plant in each hole, leaning plants from them, and a man can fasten them very rapidly. We have found this the most rapid method of transplanting. If the soil contains the proper amount of moisture, little or no watering is necessary immediately after transplanting. When water is needed it is just as well to

place flats in the cold frame or greenhouse and give the plants time to straighten before watering.

When the flats are placed in the cold frames very little or no ventilation is given until the plants are established, which, under favorable conditions, requires only two or three days. It is best to keep a humid atmosphere until new roots are formed, and this cannot be accomplished if ventilation is too free. If the sun is very hot, which may be the case in the spring when tomatoes and peppers are transplanted, the frames should be shaded with straw mats turning back the edges of the mats six to twelve inches to admit light and sunshine. Look the boxes over daily and water only the dry spots. After the plants have made a good start, admit plenty of air and keep soil moist. Close the sash towards evening before the air gets too cool and if the weather is quite cold, place mats on the frames not later than four o'clock in the afternoon. Remove mats early in the morning, if the weather permits, and when there is no danger of freezing, the mats should not be put on the frame until as late as possible in the evening.

The plants of cabbage, lettuce and cauliflower should be well hardened before setting in the field. After they have reached the proper size give them all the air they will stand. When the plants have had a few days of free exposure to the air by removing the sash, leave off the mats for two or three nights and then do not cover with sash at night. If the process of hardening is gradual the plants may finally be frozen stiff in the frames without damage, and, after freezing in the frame, they will stand almost any amount of hard freezing in the field.

STABLE MANURES.

Most market gardeners use large quantities of stable manures as a means of securing plant food and of getting vegetable matter into the soil. It is seldom that any criticism is made concerning the free use of stable manures because, applications thereof generally bring good results. The value of such manures, however, depends upon a number of conditions which the gardener should fully understand, whether he is using manures from the home stable or from livery stables.

In the first place, two-thirds the value of manure is in the liquid. Now, if the stable floor does not hold the liquid, it will readily be seen that such manure is greatly deficient in plant food. Most of the quickly available fertility is in the liquid, so that if this escapes through leaky floors, or by leaching out of doors, the best part of the manure is lost. Those buying manures regularly from livery stables would do well to examine the condition of the stable floors. No gardener or farmer is excusable for having leaky floors in his own barn stables when it does not cost any more to make floors of cement than of lumber.

Much of the manure purchased has fire-fanged until most of the nitrogen has escaped. Manure of this character should be avoided, if possible, and yet the gardener is often glad to purchase anything that can be found in the way of manure, because he must have vegetable matter, while he can depend upon commercial fertilizer to furnish available plant food.

The best practice is to spread the manure directly on the land as fast as produced or hauled from town. It is immaterial whether the soil is frozen hard or covered with snow; it is economy from every standpoint to apply at once. The loss will be very slight unless the soil is covered with a sheet of ice when surface-washing might cause a considerable loss. Our own practice is to apply fresh manures during the winter season. Partially decayed manures are preferable for crops which do not require much nitrogen, but the use of rotten manure instead of fresh is not as popular as formerly. Fresh manures applied sometime before planting, when this is possible, are not objectionable for most garden crops.

Some vegetables, as cabbage, cauliflower, lettuce and onions, utilize to the best advantage very heavy applications of manure. Fifty tons of manure per acre can be applied with profit for cabbage, while this amount is not necessary when commercial fertilizers are used liberally. Ten to fifteen tons per acre, supplemented by fertilizers, give excellent results; but there is little danger of the gardener using too much manure. Soil which has been heavily manured for cabbage, cauliflower, lettuce, celery and other crops will not need very much, if any manure the following year when planted with tomatoes, peppers and the root crops, especially with the free use of commercial fertilizers.

GREEN MANURES.

The most important matter in increasing or maintaining fertility, is the addition of vegetable matter to the soil in the form of stable manures or green crops. Stable manures generally give quicker results because of the larger percentage of more available plant food in them than in green crops. So far as ultimate results are concerned, the nature of the vegetable matter introduced into the soil is of little importance except that the legumes possess superior merits because of their high content of nitrogen.

Humus is vegetable matter in the process of decay. Its virtues are many. It increases the water-holding power of soils, making them less susceptible to drouths. It keeps the soil loose and friable and prevents surface-baking to a serious extent. It renders soils more easily cultivated. It increases the supply of available plant food. It is favorable to the work of bacteria, and soils containing the largest percentages of vegetable matter generally contain the largest number of bacteria. The gardener who expects success must do everything possible to increase the supply of humus. This may be done in three ways, namely: By the use of stable manure, catch crops and crops grown especially for green manurial purposes.

The extent to which green manures can be profitably used depends upon the value of the land, the line of gardening followed and the acreage of tillable soil. The gardener operating on a large farm has an opportunity to maintain and increase the supply of vegetable matter in his soils without resorting largely to the use of stable manures. If a small acreage is being farmed or trucked and manures can be hauled and applied at moderate cost, it is more profitable to crop the land every year. But gardeners who have plenty of land can use green crops with splendid results. Green manures can often be used with excellent results in the restoration of so-called "worn out" lands. Soils are said to be "worn out" or exhausted when they

fail to yield paying crops, and this failure is nearly always due to a deficiency of humus.

The writer has used with the best results the following plan, on ground which was greatly lacking in vegetable matter. The soil was plowed in August, thoroughly harrowed and sowed in rye early in September, using two bushels of seed and 300 pounds of a high-grade, home-mixed fertilizer per acre. The rye made a fair growth and was plowed under when about three feet high the following spring. We then sowed oats and Canada field peas, using seed and fertilizer freely, compacting the soil thoroughly before sowing. When the oats were shooting into head, they, with the field peas, were plowed under. The soil was again plowed and prepared for rye, which constituted the third consecutive green crop, and this was plowed down the following spring and the ground planted in Danish ball cabbage. On account of exceedingly dry weather during late summer and throughout the fall, the cabbage crop was only a partial success. We were anxious to give the plat a fair chance, so the following season we planted late cabbage again, following cabbage with cabbage, contrary to our usual practice, but the results were most gratifying. This is now one of the best pieces of ground on our farm, and although the course of green manuring described seems somewhat expensive, it proved a very profitable investment. The good results of this course of green manuring will be noticed for years to come. After harvesting the cabbage last fall, the ground was plowed. It was limed in the spring and sown in red clover, using ten quarts of seed per acre and with no nurse crop. This will give a heavy growth of clover to be plowed down the following year, when cabbage will be planted again.

An excellent plan and less expensive than the foregoing, is to plow the soil early in the spring, destroy early weeds by harrowing at intervals until the 15th of May and then sow clover, covering the seed with a weeder. Another successful plan with us is to sow clover seed in August. The weeds are not troublesome at this season of the year, and a fine growth of clover will be secured to be plowed under the following year. Spring sowing gives the largest amount of vegetation, which is a decided advantage if the crop is wanted to be plowed under early the next spring. Another excellent plan is to use oats, or oats and Canada field peas for the first crop, plowing under in July or August, and then sow red clover or the mammoth, to be plowed down the next year.

It is frequently possible to remove early vegetables in time to sow one of the clovers, and, wherever the legumes can be worked into the rotation of vegetables, they will prove highly beneficial. Although the legumes are by far the best crops for manurial purposes it is not always possible to use them. Rye can often be sown late in the fall when clover would not likely succeed. When rye is used it is an advantage not to plow too soon in the spring so there will be plenty of time for the rye to make considerable growth. This time can be allowed when the soil is wanted for late cabbage or late tomatoes or crops which should not be put out until after danger of severe frosts. Rye is a splendid crop to plow under for potatoes, for the tubers seldom scab in such soils. We have been told that cabbage will not be troubled with the disease of club root when grown in soils in which crops of green rye have been plowed under

but we cannot vouch for the correctness of this statement, though we cannot from out own experience, contradict the assertion.

It is difficult to derive much benefit from catch crops, as tramping over the ground in gathering the vegetables is very destructive to the young plants. In the majority of cases, it is better to plow after removing the vegetables and raise a green crop expressly for manurial purposes. So far as economy is concerned, it is often less expensive to supply the humus by green manures than by stable manures.

COMMERCIAL FERTILIZERS.

Successful market gardeners recognize the importance of the liberal use of commercial fertilizers. Some growers depend mainly on stable manures, but comparatively few succeed without using large amounts of commercial fertilizers. The profitable use of such plant foods depends upon the intelligence with which they are purchased and used, and also upon the degree of perfection of all other conditions which are favorable to crop production. It seldom pays to use a ton of high grade fertilizer per acre when second or third grade plants are set and probably put out too late in the season to produce really early vegetables. Liberal fertilizing will not likely pay when both plowing and harrowing lack thoroughness, and the crop is not cultivated as frequently as is necessary for the best results. Fertilizers applied in large amounts usually pay a good profit when all other conditions are as nearly right as possible.

It is not an easy matter to determine just what kind of fertilizer will give the best results. We need not concern ourselves about any of the fourteen elements of plant food, except nitrogen, phosphorus and potash. The best index as to the needs of any partciular soil is the character of the field crops grown before planting vegetables. A vigorous growth of stalk and leaf, the leaves showing a rich, dark green color, are positive indications that the soil contains a liberal supply of nitrogen, but even such soils generally need more nitrogen for the most profitable gardening operations, than is necessary for general farm crops. Sandy and gravelly soils are nearly always deficient in potash, and when this element is wanting, there is a lack of vigor shown in the wood of the tree fruits, the fruits are not of high quality, and the grasses do not make a thrifty growth. Clay soils usually contain an abundance of potash but not so much phosphoric acid, so that phosphates are generally needed in such soils; in fact, they are needed in nearly all classes of soils.

In the production of vegetables, the aim is to secure tenderness and succulence, and rapid growth and quick maturity are necessary to secure these qualities. The three elements of plant food named are important in growing early vegetables, but nitrogen, in the most available form (nitrate nitrogen), exerts the greatest influence in hastening maturity. In intensified gardening, however, we cannot afford to take chances of getting poor results by withholding any one of the three elements, so that the safe practice is to use a complete fertilizer, which will, according to our best judgment, meet the special requirements of the soil to be tilled and the crop to be grown.

Vegetables of a distinct leafy nature as cabbage, lettuce, kale and spinach, utilize to good advantage heavy applications of nitrogen, while large amounts of this element applied to tomatoes, peppers

and egg plants, would be disastrous by encouraging excessive growth of leaf and stem without much fruit. The mineral elements should be used freely with all vegetables and particularly with the ones last named and also with the root crops.

FORMULAS SUGGESTED FOR FERTILIZERS FOR DIFFERENT VEGETABLES.

	Per cent. of nitrogen.	Per cent. of phosphoric acid.	Per cent. of potash.
Asparagus,	4	8	10
Beans,	2	8	10
Beet,	4	8	12
Brussel's sprouts,	4	8	8
Cabbage, early,	6	8	10
Cabbage, late,	4	8	10
Carrot,	4	8	12
Cauliflower,	4	8	10
Celery,	4	8	10
Corn, sweet,	4	8	10
Cucumber,	4	6	8
Egg plant,	4	5	9
Horse-radish,	4	8	12
Kohl-rabi,	4	8	10
Lettuce,	5	8	10
Melons,	4	6	8
Onion,	6	8	10
Parsley,	5	8	10
Parsnip,	4	8	10
Peas,	2	8	10
Peppers,	4	8	10
Potatoes,	4	8	10
Pumpkin,	4	6	8
Radish,	4	8	12
Rhubarb,	5	8	10
Salsify,	4	8	10
Spinach,	5	8	10
Squash,	4	6	8
Tomato,	4	8	10
Turnip,	4	8	12

The fact should be emphasized that the above formulas are merely suggestive and every gardener must decide for himself whether the amounts of the various elements would be best for his particular conditions. For example, in growing a crop of late tomatoes, there is doubtless instances where the soil has been well enriched with nitrogen by plowing down clover and manure for a crop the previous year, and it might be desirable not to use any nitrogen or a small percentage of this element. It is always safer to apply liberal amounts of the mineral elements, while the amount of nitrogen may vary considerably.

The tendency among successful gardeners is to apply more rather than less fertilizer per acre. A large amount of labor is involved in the preparation of the soil, planting and care of the crop, and it is poor economy to feed the plants on a half ration. All plants must be fed liberally to secure the best results and the largest profits. One thousand pounds of fertilizer per acre is not enough for most garden crops. One thousand five hundred to 2,000 pounds will

usually return larger profits and double these amounts are sometimes used with such crops as lettuce, celery and onions.

Application is best made by broadcasting after the soil has been plowed and leveled by dragging. The application may be made by sowing by hand, or better, with a two-horse distributor which will apply the material more evenly and regularly than is possible by hand.

We have practiced and advocated the home-mixing of fertilizers. The operation has an educational value. As the mixtures are prepared and handled year after year, a knowledge is acquired of the use and effects of plant foods and the gardener becomes more deeply interested in the subject of plant nutrition. Practical plant feeding becomes a subject of constant study, and modifications in rations are often suggested by changing conditions which arise from year to year.

Home-mixing generally saves from $5 to $10 per ton, and this is quite a consideration when much fertilizer is used. It is an easy matter to determine from the analysis the commercial value of factory mixed goods. Nitrogen in the form of nitrate is worth about 16 cents per pound. It is generally safe to calculate the phosphoric acid and potash at 4½ cents per pound. Suppose that the analysis on a bag calls for 4 per cent. of nitrogen. This means 4 pounds of nitrogen in every 100 pounds of fertilizer, or 80 pounds in a ton, worth, at 16 cents per pound, $12.80. If the analysis calls for 8 per cent. of phosphoric acid, the ton will contain 160 pounds of this element worth, at 4½ cents per pound, $6.80. Ten per cent. of potash would be 200 pounds in a ton, worth at the same price as phosphoric acid, $8.50. The cost of mixing does not exceed 50 cents per ton. By summing up, we find that the total cost of this fertilizer is $28.60.

Suppose we wish to mix a fertilizer with the foregoing formula, 4-8-10, and we have on hand nitrate of soda, 14 per cent. rock phosphate and muriate of potash. Nitrate of soda contains about 16 per cent. nitrogen. According to the calculation just given, we will need 80 pounds of nitrogen. Dividing 80 by 16 we ascertain that 500 pounds of nitrate of soda is required for a ton of fertilizer containing 4 per cent. of nitrogen. It will take 160 pounds of phosphoric acid. Dividing 160 by 14, the per cent. of available phosphoric acid in the phosphate used, we find that 1,143 pounds of phosphate is needed. Two hundred pounds of potash is required. Muriate of potash contains 50 per cent. of actual potash so it will take 400 pounds of muriate of potash to supply this element. These amounts make a total of 2,043. If a low grade fertilizer is mixed the various materials named would not make a ton, and it will be necessary to use a filler, as sand, dry earth or other foreign material if we want a full ton in weight. The filler is the best part of a pudding, but it is of no value whatever in the fertilizer except to increase the receipts of transportation companies. When factory mixed goods are used it is always cheaper in the end, that is, you get more for your money, to buy those of the highest grade.

Another advantage of home-mixing is that we can mix the ration to meet the requirements of the crop to be grown. Nearly every gardener grows a diversified list of vegetables, which vary more or less in food requirements, and the feeding problem is entirely under the gardener's control when the rations are prepared at home.

The actual mixing is a very simple operation. The various materials for half a ton, or a ton if preferred, are weighed and placed in separate piles. A sand screen six feet long and three feet wide, with a quarter-inch mesh, is fastened securely to a frame and stood on the floor at an angle of about 45 degrees. The floor should be even and smooth. Take shovelfuls alternately from the different piles and pass through the screen. The lumps will roll to the bottom of the screen and may be broken with the bottom of the shovel. After passing all the materials through the screen, set the frame aside, turn the pile twice, and bag, putting 100 pounds in each sack. Mixing should not be done more than a month before applying in the field or the fertilizer may get lumpy, causing trouble in drilling.

When a more lasting effect is desired than will result from the use of nitrate of soda, other materials, as dried blood, fish scraps, cottonseed meal and tankage may be substituted or used in addition to smaller amounts of nitrate.

The New Jersey Agricultural Experiment Station has issued a bulletin on the use of nitrate of soda for garden crops, and the publication should be of special value to market gardeners. It cites many experiments showing the most profitable use of nitrate applications being made both before and after planting. The writer has used nitrate of soda with splendid results by top-dressing around cabbage and tomato plants. The only objection to its use in this way is the difficulty in finding time and labor to make applications during the growing season when so much work demands prompt attention.

LIME AND LIMING.

The market gardener can often use lime to good advantage and its uses and benefits should be fully understood. Lime is not valuable as a direct fertilizer to any of the garden crops, as all soils contain enough to meet the fullest requirements of all kinds of vegetables.

One effect of lime is to release various elements of plant food stored in the soil, converting them into forms that can be assimilated by growing plants. This value should not be overlooked, particularly in the liberating of potash which is present in large quantities in practically all Pennsylvania soils. Lime is also valuable in unlocking the nitrogen in peat and mulch lands, which are especially well adapted to the growing of celery and onions. Applied to stiff clay soils, it renders them loose and friable, while it binds together sandy soils, thus making them more retentive of moisture and fertility. Lime, also, corrects the acidity of sour soils, which condition is disastrous to the culture of the legumes, as the clovers, peas, beans and vetches.

When green crops are plowed under, there is more or less tendency of such material to sour the land and applications of lime after plowing under of such crops, sweetens the soil and thus secures a more favorable condition for the growth of clover. It is important to work in the clovers at every possible opportunity and a sweet soil must be maintained to get the best results with any of the legumes.

Lime is the best known preventive of club root. It doesn't always prevent this disease, but it is usually effectual.

It is an easy matter to determine whether a soil needs lime. Five cents will buy enough blue litmus paper to test a large field. The paper may be procured at all drug stores. Cut the paper into narrow strips and make tests in different parts of the field by pressing the moist soil into close contact with the paper. If the paper turns red in a few minutes, a sour soil is indicated and lime should be applied. The degree of acidity will be shown by the extent to which the blue paper turns to red, there being only a very slight change if the soil is not very acid.

Lime may be applied with success at any season of the year. Fall is generally preferred, but there can be no evil effects from spring applications, even at the rate of 100 bushels per acre, if the lime is thoroughly incorporated with the soil by frequent harrowing.

If the land is largely devoted to the culture of cabbage, it will probably be best to use large applications. Stiff soils should also be limed heavily. But if the object is simply to sweeten the soil, it is not necessary to apply more than a ton per acre, and this is too much for many soils. Some kind of a drill or lime distributor is necessary in making small applications.

TILLAGE.

The productive power of the soil is not dependent upon any one condition, but a number of factors enter into the problem. The physical or mechanical character of the soil has as much, if not more to do with crop production than anything else. Good plowing, good harrowing and good cultivation are more important in growing vegetables than commercial fertilizers, however important the fertilizers may be.

Tillage puts the soil in the proper condition for seeding or planting and maintains a suitable texture. Tillage is necessary to destroy the weeds, but it would be almost as necessary were there no weeds to combat. Tillage controls the supply of soil moisture which is so highly essential in growing large crops. Tillage aerates the soil which is necessary to plant growth. Tillage maintains a more favorable condition for the life and work of soil bacteria.

Tillage begins by plowing, and this operation should be thorough and as deep as possible. If the soil is shallow it should be gradually increased in depth by plowing slightly deeper each year until the proper depth has been secured. Soils which do not become plastic during the winter and which are naturally heavy and tenacious are benefitted by fall plowing. Soils plowed in the fall become great reservoirs of water by spring, and if the harrow and drag are used the first day the ground is sufficiently dry, enough moisture will be held in the soil to meet the requirements of early crops for several weeks. When fall plowing is not feasible or desirable, the work should not be delayed in the spring a day longer than necessary.

After plowing, the harrow and drag, or, clod crusher, should be used until the soil is thoroughly fined. Our own experience has taught us that disc harrows are almost indispensable in the preparation of the soil. Next to the disc harrow, we value a plank drag. As a pulverizer and leveler the drag is much more effective than a roller. Whatever tools are employed after plowing, continue their use until satisfied that the soil is thoroughly prepared for seeds or plants.

After planting, cultivation should begin as soon as possible. Cultivators with not less than twelve small teeth or shovels are the most satisfactory for general purposes because they leave the soil in the finest state of division and are also the best conservers of moisture. Cultivation should never be neglected. The surface of the soil must be kept loose and friable to encourage steady and rapid growth.

MARKETING GARDEN PRODUCE.

Some gardeners succeed very well in producing large crops of high grade vegetables, but fail to make much clear profit because the produce is not sold at satisfactory prices. Paying prices have not been received because of failure to procure really early vegetables, failure to use clean, neat packages of the right kind, failure to properly sort and grade, failure to give full measure, failure to market promptly when the crops are ready, failure to fully appreciate the value of the crops and consequent failure to ask a reasonable price, etc., etc. In brief, it is one thing to produce garden crops and quite another to make satisfactory disposition. The question of marketing demands just as close study and attention as the question of production.

It is exceedingly important to have vegetables for sale at the earliest possible date because this enables the grower to catch the highest prices, and it is also the entering wedge to the market, which, in a very short time, may be overcrowded with produce. The grower who reaches the market first has a great advantage over those who are even a few days later. Again, if sales are begun very early, the bulk of the crop is sold before the "slump" comes, and it is not then so difficult to dispose of the remnant of the crop.

When several markets are accessible, it frequently happens that one is paying higher prices for a given vegetable than other markets in the same section. Telephonic communication with all available markets is a necessity to the gardener, if he desires to keep posted concerning the prevailing prices of his markets.

An effort should be made to produce such crops as are in the keenest demand on the home market. The writer is engaged in producing cabbage on quite a large scale, and finds little difficulty in making disposition of the crop to a population which is largely foreign and consumes an immense quantity of this vegetable. While if we should grow any considerable quantity of peas, beans and lettuce for our particular markets, there would not be sufficient demand for the large supply.

It is a decided advantage to produce on a scale large enough to make daily marketings or at least three times a week. When sales are made the merchants can be informed just when you are coming again, and if your vegetables are satisfactory and prices reasonable your customers will patronize you regularly instead of buying promiscuously from a large number of farmers.

The possibilities are greater to produce on a scale large enough to justify wholesaling instead of retailing. The gardener's time is more valuable in producing than in peddling. It happens very frequently, too, that retail prices are very little better than wholesale prices, and the work of retailing is much greater. Some gardeners

produce in a wholesale way and sell by retailing to consumers and find the method very profitable. But such instances are the exception rather than the rule.

It is an advantage if the market can be reached conveniently by wagon, yet shipping by rail has advantages too, especially if the shipping point is not too remote from the farm. Those who ship are not bothered with the fatigue and discomfort of rising sometimes soon after midnight and riding long distances to market and then possibly finding the market flooded. The gardener who makes a specialty of one or more crops and ships to the city will not likely find his business as profitable as those who operate near large cities and market by wagon, but he may get more comfort out of life, and he is in a position to produce on a larger scale.

The crops must be gathered in the proper condition and sent to market fresh and clean. Careful grading is absolutely necessary. A few small, inferior specimens in the package are always noticed by careful buyers. Even a single specimen may be the means of repelling a buyer, and it is the best policy to have the product run uniform throughout the package. If inferior specimens are to be used, better place them on top than in the bottom of the package. It is best to pack and sell all inferior grades by themselves or keep at home and feed to stock, if this is possible.

Packages should be neat and clean. New packages are preferred although second hand baskets and crates cost less money. Use the style of package that the market demands and which is the most profitable for the gardener to use. As a rule, the smaller package should be used early in the season when prices are high, and larger packages when prices are low. Use packages of standard size and give full measure. A basket of tomatoes will catch a buyer if it is full and well-rounded. Nothing is ever gained by stinting the measure. On the other hand, the gardener must be firm on this matter, for it is next to impossible to satisfy some merchants. See that produce, packages, wagon, team, harness and driver are neat and clean, and the entire outfit will be a good recommendation of the wares for sale.

SEED.

The gardener cannot be too careful in procuring his supply of seed. Failures and disappointments often result from the use of seeds which are too old or not true to name. Trouble from these causes are not so common as formerly for we now have a large number of reliable seedsmen who are extremely careful concerning the purity and quality of their stock.

Gardeners often censure dealers for furnishing inferior seeds when the blame should be attached to their own carelessness or ignorance. For example, seeds of tender vegetables as egg plants, peppers and tomatoes are sown sometimes too early in the season in hotbeds with insufficient heat. The result is, most of the seeds rot, but the dealer is ever afterward blamed for selling poor seed. Again, seeds are sometimes sown in soils which do not contain enough moisture to cause germination, but the seedsman gets the blame just the same. The fact is that practically all the seeds now furnished by leading houses are of high germinating power. These establishments test

their stock before selling; at the same time, the careful gardener, to avoid all possibility of disappointment, should test the germinating power of his seeds before the main sowings are made.

It is usually safer to buy fresh seeds every year and never more than is needed for each season, and in ordering to stipulate that new seed be sent. The seeds of some vegetables possess greater vitality than others. The pioneer gardener, Peter Henderson, claimed that peas, beans, peppers, carrots, corn, egg plant, okra, salsify, thyme, sage and rhubarb were safe for only two years; asparagus, endive, lettuce, parsley, spinach and radish are safe for three years; broccoli, cauliflower, cabbage, celery and turnip are safe for five years, while the beet, cucumber, melon, pumpkin, squash and tomato may retain their vitality for six to ten years or more. But actual testing before making the main planting is the only safe practice.

It is generally best to get the supply of seeds from men who make a specialty of the seed business. They understand the production, selection, harvesting and storing much better than the average gardener. Another point which should be taken into account is that commercial seedsmen have their stock grown in various parts of the United States where soil and climatic conditions are best adapted to each particular class of vegetables. So far as economy is concerned, it is cheaper to buy all the seeds.

There are advantages, however, in home saving and the most successful gardeners produce more or less seed at home. It has been the writer's experience that it is an immense advantage to save seeds from tomatoes. No seedsman could afford to exercise the care we do without charging prices which gardeners would refuse to pay. With home selection the strain should improve from year to year. Seed may be saved at home from squashes, melons, cucumbers, sweet corn, peppers and other vegetables, and with intelligent selection and care of seed there can be no possible objection. When seeds are saved at home, the results should be carefully observed from year to year and if any deterioration is noted, which can be determined by growing for comparison, plants from regular stock seed from dealers, a change of seed can be made the following year. But careful, intelligent selection does not usually result in deterioration.

When seeds are bought from regular seedsmen, it is desirable to purchase from the introducer, who exercises greater care than those who have no special interest in the variety.

In field culture, the most important matter in the germination of seeds is the supply of moisture. Satisfactory germination cannot be secured with an insufficient amount of soil moisture. Thorough preparation of the ground is essential. It is also frequently necessary to firm the soil after sowing or drilling. This may be done with the feet, the back of a spade or by rolling. A firm seed bed, bringing the seed into intimate contact with moist soil is the secret of quick germination, provided the ground is warm and the depth of covering not too great.

Soaking seeds of slow germination, as the beet, parsnip and carrot, is practiced sometimes with good results. With the proper seed bed, however, soaking is seldom necessary, especially if the ground is thoroughly firmed after planting.

ASPARAGUS.

No vegetable responds to generous treatment better than asparagus. It appreciates a deep, rich, sandy loam, but may be grown successfully in any well prepared, loamy soil. Ideal conditions for this vegetable are afforded by the saline sands near the sea, but there are many fine and widely distributed inland plantations.

The roots are grown from seed, sown early in the spring in the garden, or started in cold frames, transplanting into the garden. Asparagus seeds are very hard and slow to germinate, and soaking in warm water for twenty-four hours before drilling, is a desirable practice. Drills should be one foot apart and the plants thinned to about two inches apart in the row. Roots either one or two years of age may be purchased of nurserymen or seedsmen, if this is preferred. One year old roots are commonly planted by commercial growers.

Preparation for planting is made by deep plowing and deep and repeated harrowings. The ground must be thoroughly fined. After plowing and before much harrowing is done, two or three inches of rotten manure should be applied and a small quantity of common salt will also prove beneficial.

When the ground is fully prepared, mark furrows six inches deep and five feet apart. Place roots in the bottom of the furrows two feet to thirty inches apart. Cover three inches deep and at each successive hoeing, draw the soil into the furrow until even with the surface of the ground.

Rotten manure and some salt should be spaded or worked into the soil about the plants every spring. The second season from planting, two or three cuttings may be made and the third season there should be a full crop. With proper cultivation and manuring an asparagus plantation will produce profitable crops for twenty years. Conover's Colossal, Barr's Mammoth and Palmetto are the leading varieties.

BEANS.

The bush, dwarf snap, or string varieties thrive best in rather heavy loams which have been well enriched. The preparation should be thorough, harrowing until the soil is deep and fine. Beans should not be planted until the soil is quite warm and dry. Earlier plantings may be made on southern exposures, especially if the soils are well drained. The drills should be far enough apart to work conveniently with a horse. After plants are up, thin to about four inches apart. For successive crops, plant at intervals from May until August.

Among wax-podded varieties may be mentioned the Yosemite Mammoth Wax, Golden Wax and Valentine Wax. For green podded varieties, Early Mohawk, Earliest Red Valentine and many other good varieties may be planted.

Lima beans should not be planted until the ground is thoroughly warm. Bush limas may be planted in hills three feet apart each way, or eighteen inches apart in drills three feet apart. Burpee's bush lima and Henderson's or Woods' bush lima are probably the best varieties. Pole limas succeed best in rich, sandy or loamy soils and are planted in hills three feet apart with four feet of space be-

tween the rows. The poles should be set before planting. To be certain of four plants at each pole the common practice is to place six to eight seeds in each hill. Early Leviathan is one of the best pole lima beans, and King of the Garden is a standard late variety.

Other pole or running varieties are planted and cultivated about the same as the pole limas. The Garden Cluster Wax is an excellent variety of this class, and there is probably nothing superior to Old Homestead as a green-podded pole bean.

BEETS.

The finest beets are grown in rich, sandy loams, although excellent crops are produced in slightly gravelly clay loans. Beets demand a loose soil with a liberal supply of humus.

Fresh manures should not be applied immediately before sowing or drilling of the seed, but rotten manures may be used freely, working into the soil by harrowing, preferably with a disc. Drill seed one inch deep in rows twelve to fifteen inches apart. For early beets, sow in the spring as soon as the ground can be prepared, and for the late crop sometime in June. Frequent cultivation is necessary for the best results. Among early varieties, Early Egyptian, Eclipse and Crimson Globe are largely grown. Bastian's Blood Turnip is an excellent second early variety and Long Smooth Blood-Red is a fine late variety.

EARLY CABBAGE.

Early cabbage is one of the most profitable garden crops, and its culture offers fine possibilities in many sections. Early cabbage thrives in almost any fertile soil, although sandy soils are more favorable to early maturity than those containing considerable clay. A rich, well-drained clay loam, however, is less expensive to maintain in a productive state, and this superiority offsets, to a great extent, the advantages of sandy soils. Many gravelly clay loams in the State are well adapted to early cabbage, and if such soils have a southern or southeastern exposure the conditions are most favorable to hasten early maturity.

Some gardeners fail to reach the market as early as they should because of delay in starting the plants. All necessary preparation of the hotbed must be made in ample time so the seed can be sown the latter part of January or early in February. When early sowings are made the plants need not be forced rapidly, and by free ventilation and moderate watering the plants may be kept short and stocky. Transplant in about four weeks or before the seedings get spindly, and give careful attention in the cold frame. Fig. 8 illustrates a flat of early cabbage plants ready for the field. (For details on raising plants, see chapter which relates to this subject).

The thorough hardening of plants before setting in the field is a matter of great importance. If the leaves have a dark blue color with a reddish tinge, the plants will stand very severe freezing when set in the field. To secure the best results the plants should be large enough and tough enough to place in the field the first day the ground can be prepared. In the mountainous and colder parts of the State transplanting into the field can usually be done from the 10th to the 20th of April, while earlier planting may be practiced in southeastern sections.

FIG. 8.—A flat of early cabbage plants ready for the field.

Previous to planting in the field, the ground should be put in a fine state of division so there will be an abundance of loose soil to press about the roots. Not only should the surface be fine and mellow, but the soil to the depth of the plow furrow should be made loose and friable.

Not less than a ton of fertilizer should be applied for the most profitable results and the plant food should be highly nitrogenous. It is also important that the food elements be in quickly available forms. Nitrate of soda is the most valuable of all fertilizers for early cabbage because it can be assimilated by the plant just as soon as dissolved. Some of the most successful producers of this crop mix a ration which contains about six per cent. each of nitrogen, phosphoric acid and potash. This formula may be varied; but the most essential factor is nitrogen and this element must be used liberally. Stable manures should be applied in large amounts and these will supply considerable nitrogen, but it is poor economy to withhold nitrogen because a lot of manure has been used.

Some gardeners prefer to drill or broadcast all the fertilizer and not use any in the hill. Our own practice is to broadcast about fourteen hundred pounds of a complete mixture and then use in the hill about five or six hundred pounds of finely ground pure bone meal. The quantity held in the hand of a small boy is sufficient for each plant. There is no danger of injuring the roots of the plants by the free use of bone meal and it gives the plant a quick start. Theoretically, bone meal is considered a slowly acting plant food but practice shows that it has almost an immediate effect in starting the plant as well as in nourishing it during the entire season of growth. There is a possibility, too, that the phosphate of lime in bones has at least some effect in preventing club root.

We want to emphasize the importance of liberal fertilizing in growing early cabbage. Inexperienced growers frequently make a serious mistake by using entirely too limited amounts of fertilizers. Fertilizers do not increase in any other way the cost of production, and it does not pay to plow, harrow, plant and cultivate, and then fail to give the crop all the food it will utilize.

Having gone to considerable expense in preparing the soil and in adding manure and fertilizers, it is important to set the plants close together. Our own experience has taught us that from the standpoint of profit there is much more danger in getting the plants too far apart than too close together. Early Jersey Wakefield may be planted in rows twenty-six inches apart and fourteen inches apart in the row. Charleston Wakefield needs slightly more space. Early Summer, Succession, All-Head, All-Seasons, Early Flat Dutch and cabbages of this type need not be set farther than eighteen inches by twenty-eight inches. (For the number of plants for an acre, set at various distances, see table on page 52).

Cultivation after planting should begin as soon as the plants have straightened and repeated often enough to keep the soil loose and mellow. Deep tillage after planting should never be practiced unless after prolonged heavy rains which have compacted the soil, or in case weeds or grass have gotten a firm hold. The best growers on Long Island cultivate shallow and all deep running cultivators were discarded years ago. A spike-toothed implement or a twelve-

toothed cultivator, as the Planet Jr., is an excellent tool for early cabbage as well as for all garden crops worked by horse power.

Early Jersey Wakefield is the most extensively grown of the earliest varieties and there is nothing better for the main early crop. Charleston Wakefield is considerably larger, and excellent to follow Early Jersey Wakefield. Both of these varieties produce, hard, conical heads. As a second early cabbage, producing flat heads, Early Summer is not surpassed. The heads are of good size and usually solid. Succession is a splendid variety to follow Early Summer. It is a sure header and considerably larger than Early Summer. The four varieties just named, as well as a special strain of Wakefield produced by M. Garrahan, of Luzerne county, are grown most extensively by the writer for the early and second early crop. All of these varieties are started in the greenhouse at the same time, the latter part of January. There are many other excellent varieties of early and mid-season cabbages. Early Flat Dutch and All-Head possess special merit, but they are no better than Succession.

The best manner of marketing early cabbage depends upon the market to be supplied. It may be sold by the crate, barrel, pound or head, and each method has its merits. When southern cabbage is selling in crates at high prices, it is generally most profitable to market the home crop in second hand crates of the Baltimore size and exchange crates on your local market at each delivery. When shipped cabbage is being sold in crates and the price is low and it is difficult to make sales, barrels of full capacity, which hold at least one-fourth more than the Baltimore crate, will help to make quick sales. It is sometimes an advantage to sell by the pound, particularly when there is little competition. The merchants' price will then be regulated by that of the grower, and if the competition is not too keen, a good price can often be maintained for quite a long period. Selling by the head or hundred heads or so many heads for a dollar is the most convenient way of handling and selling in local markets. The heads can then be loaded directly on the wagon in the field and no extra labor is involved in crating, barreling or weighing. Selling early cabbage by the head, however, if the crop is a fine one, is not usually the most profitable method, but custom often necessitates selling by the head instead of by weight or measure.

The condition of the market must determine whether the heads shall be allowed to reach full maturity, becoming hard and solid. It happens some years, that the demand for early cabbage is so keen and the price so high that merchants are not very particular and are even glad to buy heads which have not become solid and it is an advantage to sell instead of waiting for the heads to get hard when prices may be much lower.

The malady known as "club root" is the greatest and most serious enemy to the cultivation of cabbage as well as to the culture of cauliflower. It is not many years since gardeners thought this abnormal development of the root and consequent loss of vitality in the plant was caused by insects. But this idea is no longer held by intelligent growers, for the trouble is caused by a law form of fungus, and insects have nothing to do with "clubbing," although they are frequently found in the diseased parts or in close proximity. The maggot is especially likely to be found working in the affected roots.

There is no cure for club root. When the plants are once affected, the only safe course to pursue is to burn or destroy them. Effectual preventive measures, however, may be taken. Some writers recommend the destruction after harvesting, of all refuse, as leaves and stumps, and this is splendid advice for infested fields. Proper systems of rotation should be followed. It is not safe to plant cabbage in too close succession in the same ground, especially if plenty of land is available for rotating different crops. Lime is considered an excellent preventive and is used extensively in the largest cabbage producing districts. Some gardeners on Long Island grow cabbage on the same ground every other year and others almost every year, but lime is used freely. The quantity applied varies from twenty-five to seventy-five bushels per acre.

When plants are known to be affected, all possible care should be taken not to carry the soil on farm implements to parts of the farm which are free from the germs of this disease.

The green cabbage worm, which is the larva of the white butterfly, so familiar to every farmer, is the most troublesome of the insect pests attacking this crop. Various treatments are used and recommended, as Paris green, air-slaked lime, salt, hot water, pyrethrum or Persian insect powder, and several patented insect destroyers. The powder known and sold by druggists as Slug Shot is inexpensive and entirely satisfactory. Applications are made by means of a bellows or powder gun.

The well-known cabbage maggot is a serious enemy sometimes. Serious, because if unchecked, the plants soon succumb, and if combatted, considerable expense is involved. Prevention is the only practical course to pursue, and not knowing whether the pest will make its appearance or not, protection is not generally given until too late. So far as known, the most practical method of prevention is to place a disc of paper or cardboard about the stems of the plant. These discs should be about two inches in diameter with a slit cut from the margin to the center. After transplanting, the cardboard of paper is placed about the plant, and this prevents the maggots, which are hatched from eggs deposited on or near the plant at the surface of the ground, from going down to the roots. These discs may be made by cutting them from any cardboard, or building paper will answer the purpose, or they may be bought at a nominal price.

Another insect enemy which is very troublesome some years is the cabbage aphis. This pest may be destroyed by fresh, unadulterated pyrethrum or Persian insect powder, or by applications of kerosene emulsion, with ten parts of water. The spray must be applied thoroughly to the under side as well as to the upper side of the infested leaves.

LATE CABBAGE.

Those interested in the culture of late cabbage should read the notes of this bulletin relating to early cabbage, for many of the suggestions made are equally applicable to the production of the late crop. There are no material differences in the soil requirements except that late cabbage can be grown with greater success on fairly heavy soils, rather than on those of a sandy or gravelly composition. But just as much plant food is required and it pays to feed just as liberally as for the early crop. The most extensive

growers of Long Island apply about a ton of commercial fertilizer per acre, and we have found by our own experience that the largest profits cannot be realized without feeding a most liberal ration. There have been instances in our experience when we attempted to economize by using smaller amounts of fertilizers, but in every instance it greatly reduced profits. Early cabbage requires larger amounts of quickly available nitrogen because much of the growth is made while the soil is cool and unfavorable to nitrification. If legumes are plowed under or manure employed a smaller amount of nitrogen may be used than is recommended for early cabbage. The Danish Ball or Hollander requires a more fertile soil than the flat or domestic types. We believe that a great majority of growers of Danish Ball do not use nearly as much fertilizer as would prove profitable. A few simple experiments would soon settle the question. If accustomed to using five hundred or a thousand pounds per acre, double the amount and note the results. It is a fact that those who change from small to heavy applications seldom return to the practice of using small quantities. This is true with all lines of gardening.

There is a great diversity of opinion regarding the proper time to sow seed for the late crop. Climatic conditions, character of soil, exposure of the land, altitude, varieties to be grown and the purpose of the crop, all enter into the problem of the proper time to sow. In the mountainous and western sections of the State early sowings are advantageous, while later sowings are necessary in the southeastern counties. Our own practice, in Cambria county, with an altitude of about two thousand feet, is to sow Danish Ball, Flat Dutch and Drumhead as soon as the ground can be prepared. Last year we sowed the Danish Ball the 5th of April and it was not too soon for our section.

Our preferences of flat cabbages to sell for kraut in the fall are early maturing varieties, as Succession and All-Head. With rich soil, Succession should not be sown before the 10th of May, even in our latitude, and with ample feeding, goo dcare, and a favorable season, the sowing could be made slightly later. Either Succession or All-Head, when properly grown, are sufficiently large to command good prices when sold by the hundred heads. Flat Dutch, Drumhead, Surehead, and varieties of this class, are grewn extensively in other states to sell by the ton to manufacturers of kraut. As a money-maker, no late variety offers as fine possibilities as the Danish Ball or Hollander. It is easily possible to raise from ten to fifteen tons per acre, while the average crop in New York is considerable less than this.

The seed bed should be fertilized about the same as the field where the crop is to be grown. See that the bed is free from stones, sticks and other rubbish which would interfere with drilling and cultivation with the wheel hoe. Make drills twelve or fourteen inches apart. Test the drill on a smooth floor or road and see that about twelve to fifteen seeds are dropped per each inch of drill. If the ground is drier than usual, set the drill shovel so the seed will be covered a full half-inch, but be careful not to cover much deeper than this. After plants are well up the ground should be cultivated several times with a wheel hoe.

Set in the field when the plants are from five to seven inches high. This work may be done by various methods. Extensive growers use machines with splendid results. Some plant with dibbers, pouring a small quantity of water into each hole before the plant is fastened. This is a good method, but rather slow and troublesome. Our own practice is to place in furrows. These furrows may be made with any kind of a shovel plow or marker and should be deep enough to have plenty of loose soil to draw about the roots. We generally have six furrows marked ahead of the droppers and planters. Besides the man who with a horse marks the furrows, another man and fourteen boys are required to plant the most rapidly. Two of these boys drop the fertilizer (generally bone meal) in the furrows at the required distance. Six boys, a boy for each row, drop the plants. Very small lads can do this. Larger and more reliable boys fasten the plants, pressing the soil firmly about the roots. The man has charge of the boys and occasionally helps a boy when he gets behind. By this method, and when the soil is fine and in proper condition, a force of the above number will set forty or more thousand plants per day. It can be seen that the work of transplanting, when well organized, is neither tedious nor very expensive. The past season, when we raised the best lot of Danish Ball ever grown on our farm, the field was planted the 7th and 8th of June. Succession planted by the fourth of July will have plenty of time to mature, if the soil is rich.

Various methods of storing winter cabbage are used with good success. The Danish Ball is the best keeper that can be grown, and it can be kept in a great variety of ways without material loss. In large producing districts, storage houses are designed and built especially for the purpose. These houses are usually constructed with double walls, or in such a way as to be practically frost-proof. Many growers store in cellars, barns or caves. Some construct pits for the purpose, while others pile or store the untrimmed heads in protected spots, as along fences, covering after severe weather begins with straw, leaves or other coarse material. Burying is a favorite plan with some and there is no better way to preserve cabbage in a fresh, crisp condition. When burying, an excellent plan is to line up on the surface of the ground three rows of heads, turned upside down, either pulling, or cutting the heads close to the ground. We prefer the latter method as it is much more pleasant to handle the crop when there is no dirt to contend with. After lining up the rows, placing heads close together, with a team and plow, draw two furrows, throwing soil as much as possible on the cabbage. Then finish with shovels, placing five or six inches of soil on the heads. After the ground is frozen to the depth of an inch or two, cover with strawy manure to the depth of several inches. We have followed this method with entire success. If the ground is well drained and the cabbage sound when buried, not a head will decay, and the Danish Ball will require little trimming when taken out. The cabbage which is sold early in the winter is stored in the stable of our basement barn. When stored in a building, ventilation must be provided and it is best not to store too much in one bulk. When sold by weight, burying is preferred, as there will be no drying out of the heads when covered by soil.

It is a mistake to delay harvesting the winter crop until the outer leaves have been frozen hard several times and when there is danger of unbroken winter weather. In our latitude we do not consider it safe to postpone harvesting later than the tenth of November.

CARROT.

The carrot does best in a warm, sandy soil, which has been heavily manured. Commercial fertilizers, particularly rich in the mineral elements, can be used with excellent results. For the early crop the seed should be sown early in the spring and later crops may be started from the 1st of May until the 1st of July. When it is to be worked by hand with a wheel hoe, the drills may be from twelve to eighteen inches apart, and from two to three feet when it is to be cultivated with a horse cultivator. It is generally necessary to thin, leaving plants from four to six inches apart. Shorthorn, Oxheart and Danver's Half Long may be relied upon as splendid varieties.

CAULIFLOWER.

It is generally conceded that cauliflower is very profitable when a good crop can be secured. But there seems to be considerable "luck" attending its culture. Causes and effects are not so well understood in the production of this vegetable as with most other garden crops. Writers do not give positive directions to amateurs or beginners or tell them how to proceed to make satisfactory results reasonably certain. In spite of the most careful and intelligent management, it is largely a "hit or miss" crop, and yet some gardeners secure profits large enough to justify its culture year after year. The culture of the vegetable demands more careful scientific study.

Heavy loams with gravelly subsoils are considered best for the cultivation of cauliflower, but the crop is grown successfully on a great variety of soils. Although it thrives best on clay loams it is produced with excellent success on some of the distinctly sandy soils of New Jersey. It is very probable that the manner in which the plants are grown and transplanted and the specific treatment and cultivation of the soil have more to do with the results than the natural composition of the soil.

The general care and culture of cauliflower is about the same as for cabbage, but requires more perfect conditions in every particular. The aim must be to encourage unchecked growth from germination until the maturity of the crop. It requires an abundance of readily available plant food and plenty of moisture. These two conditions may be secured by liberal manuring and heavy applications of commercial fertilizers and thorough cultivation. The free use of lime is thought to be valuable in preventing club root and also the damping off of plants in the seed bed as well as after transplanting into the field, which is often a most serious trouble. A prominent grower of Long Island uses shell lime freely about the plants in the field, applying immediately after transplanting.

Early cauliflower is generally regarded as more profitable than the late crop, although it requires more attention and is more difficult to produce. The early crop should be started in the hotbed

or greenhouse about February 1st, while the seed of late varieties should be sown in the garden from the first to the fifteenth of May.

Many failures in growing cauliflower are doubtless due to faulty methods in raising the plants. The best plants are procured by transplanting twice before setting in the field. The first transplanting should be made when the second pair of leaves are half an inch long, setting in shallow boxes, spacing about half an inch apart, both ways. When the third pair of leaves are about an inch long, transplant again into shallow boxes, allowing an inch and one-half between the rows. When ready for the field the boxes can be hauled and distributed over the ground to be planted. It is very important to remove plants carefully from the boxes so that as much soil as possible will cling to the roots. Cauliflower is very sensitive to check in growth, and if wilting can be prevented when transplanting it will be a decided advantage. Some growers claim that maggots are much worse with cauliflower than with cabbage, and it is well to take the precautionary method described on page 35. Early Snowball and early Dwarf Erfurt are the most largely grown early varieties. Veitch's Autumn Giant and Late Algiers are the most popular late varieties.

CELERY.

Many markets in the State are only meagerly supplied with celery of good quality. The fact is, no vegetable offers finer possibilities so far as markets are concerned. It is true that celery cannot be grown to perfection on every kind of soil. There is no doubt about the deep alluvial soils being the best adapted to this vegetable, but highly satisfactory crops can be grown in any rich garden or field soil which is naturally mellow and friable on account of the large supply of humus or vegetable matter. Market gardeners usually grow celery as a second early crop, following onions, radishes, peas, early potatoes or other spring crops. These crops are usually heavily manured so that the soil is left enriched and in an improved physical condition. Additional amounts of partially decayed manures may be used to good advantage in the preparation of ground for celery. High grade commercial fertilizers should also be used liberally, a ton per acre not being too much for the largest profits. See fertilizer table on page 53. Deep plowing and repeated harrowings and draggings are necessary to put ground in the finest possible condition.

For the early crop, the seed must be sown in the greenhouse or hotbed the latter part of February. Make very shallow furrows, two inches apart, in fine loamy soil, placed directly on the manure of the hotbed or in shallow boxes, or on the greenhouse bench. Sow seed quite thick, and after covering, firm the soil, water thoroughly and cover the ground with some kind of cloth. The cloth will keep the soil moist until the seeds have germinated. See that the soil does not become dry until plants are well up. After germination remove the cloth and gradually expose the plants to the light. If good seed is used the plan just described will insure prompt germination. When plants are about four weeks old, transplant into flats or shallow boxes using a compost made of about equal quantity of garden loam and rotten manure, and the addition of some bone

meal will improve the soil. Transplant one inch or one and one half inches apart each way in the cold frame or greenhouse if the latter is more convenient.

For the late crop the seed should be sown in the open ground early in the spring or as soon as the ground can be prepared. Select a plat of fine, moist ground for this purpose. Drill seed slightly more than one-fourth inch deep in rows one foot apart. See that the soil after drilling is well firmed with the feet or by rolling. This is necessary to insure prompt germination. If the weather is very dry and the seed not inclined to germinate quickly, covering with burlap or old carpets will hasten the process. Just as soon as the plants are out of the ground, tillage should begin, using a wheel hoe with an attachment to prevent the soil from covering the tiny plants. Destroy all weeds as fast as they appear. The plants should be ready for permanent quarters sometime in June.

The old method of planting in trenches five to eight inches deep is no langer practiced by progressive gardeners. This method involves much extra and unnecessary labor. Level culture is preferable at all times. Furrows are made from three to four feet apart and deep enough to give plenty of moist ground to draw about the plants. Celery appreciates a moist soil and the most essential factor in transplanting is to bring the damp soil into close contact with the roots. This may be done by the firm pressure of the hands. The plants are usually set six inches apart although some prefer seven or eight inches. The dwarf varieties, which are grown more largely than the tall giant sorts, may be planted in rows closer together, and this insures larger profits per acre. Celery demands close attention in the way of cultivation and hoeing. The soil must be kept loose and mellow and weeds destroyed as fast as they appear.

There are various methods of blanching celery, drawing the soil about the plants and also by using boards being the most common methods. The early crop is generally blanched by the latter method. This plan consists of placing boards on both sides of the row so that the tops of the plants barely reach the tops of the boards, pressing closely to the plants, and securing in any convenient way. The late crop is usually blanched by drawing soil up to the plants and this work is not begun until the weather is cool and the crop quite well matured. Even self-blanching varieties require this process to produce a rich, nutty flavor.

Growing celery in beds, put in ideal condition by deep and thorough tillage, heavy manuring and fertilizing, is a favorite method with some. The details of this method are given in Mr. T. Greiner's little book, "The New Celery Culture."

The winter crop of celery may be stored in houses or caves constructed especially for the purpose, or placed in trenches in the field. The latter plan is very common. It consists in digging trenches ten or twelve inches wide and deep enough to stand the plants up with their tops barely reaching the surface of the ground. The plants are packed into these trenches as tightly as possible. The crop should be stored away before there is danger of a drop in temperature to ten or twelve degrees below the freezing point. Celery plants are not injured by slight freezes but are destroyed at a temperature of ten to twenty degrees above zero. Gardeners cannot

afford to take too great risks in leaving the crop in the field after there is danger of damaging freezes, which, of course, varies in different localities. A limited supply of celery may be blanched and well preserved in any cellar where there are no stoves or furnaces, by packing in a long narrow box, first placing an inch of soil in the bottom of the box. The celery should reach the top of the box and be packed close together as in field trenching. This is a very satisfactory method in a cool, moist cellar, and it is convenient to get the celery for use any time during the winter.

There are many excellent varieties of celery. For an early crop, nothing is better than White Plume and Golden Self-Blanching. Golden Rose is a pink form of superior quality. Golden Heart is also popular. Golden Dwarf and Giant Pascal are desirable winter varieties, valued for their long-keeping qualities.

SWEET CORN.

This vegetable is not grown very extensively by market gardeners cultivating small tracts of land. It is more of a field crop and can be grown at a profit by farmers owning plenty of land near good markets. The general farmer can sell the corn and utilize the fodder for stock feeding and thus secure a double profit. It is often a good cash crop and possesses a decided advantage to the general farmer in not requiring any glass to start the plants, as is necessary with many other vegetables.

A rich, loamy soil with a heavy clover sod, manured if possible, affords the best conditions for sweet corn. Any soil which will grow a satisfactory crop of field corn will produce good results when planted with sweet corn. Of course, sandy soils and southern exposures hasten maturity, which is very important from the stand point of profit. Very early corn, however, can be procured on any rich, well-drained, loamy soil.

To get the first early corn, it must be planted slightly in advance of the field crop, and plantings made at intervals of two weeks to give a succession. When very late plantings are made, the earliest varieties should be used so the corn will be marketable before there is much danger of damaging frosts.

The early varieties producing short stalks may be planted in rows three feet apart while late varieties should have four feet between rows. The plants should stand ten to twelve inches apart in the row. For early plantings it is best to use plenty of seed, thinning if necessary. Cultivation must not be neglected if satisfactory results are expected.

Among popular varieties may be named Extra Early Adams, Early Fordhook, Crosby's Early Twelve-Rowed, White Cob Cory, Red Cob Cory, Cosmopolitan and others. For late use, Country Gentleman and Stowell's Evergreen are most largely planted.

CUCUMBERS.

This vegetable thrives best in sandy soils, but may be grown with entire success in any moderately light loam. The crop is better suited to farmers than to gardens with small tracts of land.

To procure the earliest cucumbers, they should be started in hotbeds or greenhouses about the first of March. The most approved

method is to plant in inverted sods about six inches square. These sods may be placed close together on the greenhouse bench or in shallow boxes placed in the hotbed. The sods should be covered thinly with fine soil, then plant about six seeds over each sod and cover with half an inch of fine rich soil. After danger of frost, transfer sods and plants to the field. This method enables the grower to transplant without checking the growth of the plants.

Cucumbers are usually planted in hills about four feet apart each way. Plantings in the open ground should not be made before the ground is warm, and successive plantings can be made, if this is desirable. Commercial fertilizers should be used broadcast before planting and a shovelful of rotten manure and a handful of bone meal mixed in each hill. Cultivate freely and hoe when necessary. Combat the small, striped cucumber beetle by sprinkling air-slaked lime over the plants.

Early White Spine and Everbearing are popular standard varieties. Fordhook Pickling is excellent for pickling.

EGG PLANT.

This is considered a difficult vegetable to grow, but large prices often compensate well for special care and trouble. Very early sowing does not seem to be of any particular advantage, at least, egg plant growers do not usually sow before the first of March or even later. The seeds are hard and it is impossible to germinate them at low temperatures. A good hotbed must be available where the night temperature is not lower than 70 degrees. If the seed is sown in shallow boxes and kept in a hotbed or greenhouse requiring less heat for other plants, panes of glass placed over the boxes will hasten germination. The plants thrive best with an abundance of heat. They should be grown in such a way that there will be practically no check when set in the field. An excellent plan is to grow in pots or berry baskets as described in our notes relating to the culture of tomatoes.

The soil must be fine, rich and loamy. A sandy loam well enriched with manure affords ideal conditions. Planting in the field or garden should be deferred until the weather is thoroughly warm. June 1st is soon enough in most localities and probably too soon in the coldest parts of the State. Egg plants demand thorough cultivation. About half a dozen varieties are catalogued by seedsmen. New York Improved and Black Beauty are very popular among market gardeners.

HORSERADISH.

There is nearly always a keen demand for horseradish at prices highly remunerative, and yet the supply is generally very limited. Quite recently a wholesale firm of Pittsburg informed us that their house would take all the roots we could raise and pay the full market price, which generally ranges between four and five dollars per barrel.

The crop requires a deep, moist soil to make the best roots. Average farm soils are not suitable for the business of raising horseradish but gardeners having deep sandy or gravelly loams would find this vegetable very profitable, to follow early crops as cabbage,

peas and potatoes. When grown as a second crop, pieces of the roots are planted between the rows of early cabbage, or other early crops. The usual distance is about eighteen inches in the rows and the rows two and one-half feet apart. A given plat of ground, therefore, would require about the same number of pieces of roots as cabbage plants which occupy the ground. When planted between the rows of other garden crops, the pieces should be at least three inches below the surface of the ground. This is necessary to get the roots out of reach of the cultivator teeth and also to retard rapid growth early in the season, as this is not desired until the first crops are about harvested. Horseradish planted in May, will make most of its growth after mid-summer. When planted with other crops, holes of the required depth are made with sharp dibbers. The pieces of roots should be cut square at the upper end and slanting at the lower end. The square end is placed upwards. Of course, the pieces will grow any way they are placed in the soil but the root development is more perfect when planted with the crown end up.

When planted alone, furrows may be drawn with a marker and the pieces stuck into the bottom of the furrows, or placed slanting along the sides, covering with a hoe or plow. As is well known, horseradish is entirely hardy and no injury will be done to the roots if left in the ground all winter. But the roots may be taken out in the fall and sold at once, or held where they will not dry out, and sold during the winter.

KALE OR BORECOLE.

This crop is not grown as largely as its merits demand. It is a delicious winter vegetable of the cabbage family, and not generally cultivated in the home garden.

Sowings should be made in beds of fine, loose soil anytime from the middle of April until the 10th of May, transplanting into the field or garden the same as cabbage. The seed may also be sown in September, mulching the plants with leaves late in the fall. When sown in drills where the plants are to remain, until used, thinning is necessary for the best results.

Kale is used for "greens" during the fall, winter and spring and also for garnishing purposes. Frost improves its quality. It is considered hardy above zero. The leading variety is Dwarf German or Dwarfed Curled Scotch.

KOHL-RABI.

The general conditions for the culture of this vegetable are the same as for cabbage. To get very early kohl-rabi, the seed should be sown early, transplanting once before setting in the field. Sowings may be made out-of-doors as soon as possible in the spring and for the late crop at the same time as for late cabbage.

It may also be grown in the field by drilling where the crop is to mature in rows two feet apart and then thin, leaving plants six inches apart in the rows. Early White Vienna and Early Purple Vienna are the most largely grown.

LETTUCE.

The suggestions made in regard to the raising of early cabbage plants are equally applicable in starting lettuce. The seed should

be sown at the same time as early cabbage and all the details of caring for the plants in the hotbed or greenhouse are the same. There is possibly one exception, namely, that it is better to give lettuce more space in the plant boxes than cabbage. We are able to raise much better plants by transplanting two inches apart than by allowing a space of one and one-half inches.

To secure sweet, crisp, tender lettuce the growth must be as rapid as possible. This requires plenty of moisture, an abundant supply of plant food and thorough tillage during the entire period of growth. To allow room for cultivation with wheel hoe, it is best not to have the rows closer than sixteen inches and the plants may be set in the rows about twelve inches apart. Lettuce can be grown very successfully with early cabbage, setting between cabbage plants.

There are three distinct types of lettuce, namely, head or cabbage varieties, curled or cutting varieties, and celery or "Romaine" varieties. The head or cabbage varieties are represented by Big Boston, Boston Market, Iceburg, Hanson, Tennis Ball and many others. The curled or cutting varieties are best represented by Early Curled Simpson, Black Seeded Simpson and Grand Rapids. The last mentioned variety is a beautiful lettuce of fine quality, well adapted to forcing as well as to field or garden culture. Celery or "Romaine" varieties are highly esteemed for summer use. The type is represented by several kinds of Cos.

MUSK MELON.

This vegetable should receive the same culture and attention as cucumbers, and those interested in the growing of musk melons are referred to the notes on cucumbers. Netted Gem and Rocky Ford are the most largely grown.

WATERMELON.

This vegetable is cultivated in the same way as the musk melon, except that there must be more space between the hills, which should not be less than eight feet apart each way. Two or three shovelfuls of manure and some bone meal or dried blood should be used in each hill. Plant ten or twelve seeds per hill and thin to four strong plants. Only early varieties should be used in this State. Cole's Early is one of the best.

ONIONS.

This is one of the most important and profitable crops grown by market gardeners. The interest is greatly diversified and as space will not permit full discussion here, we can give only a few of the most important points. Farmers' Bulletin, No. 39, of the United States Department of Agriculture, on "Onion Culture," prepared by the writer, gives full instructions on various phases of the subject. This pamphlet may be had free of charge by applying to the office of Experiment Stations, Washington, D. C.

Onions may be grown successfully on any rich garden loam containing considerable humus. The largest plantations of this country are made in deep black, alluvial soils, but splendid results have been achieved on soils even of a clayey composition, but not without additions of liberal amounts of rotten manure. The onion thrives

best in a loose, friable loam, and a fair amount of sand is a decided advantage. It pays to use large amounts of fine manure as well as commercial fertilizers, and at least a ton per acre of a high grade fertilizer, rich in nitrogen, should be applied broadcast before planting. Nitrate of soda is particularly valuable in growing onions. One hundred pounds of nitrate may be worked in before planting and two or three dressings of this amount during the season will facilitate rapid growth and increase the yield.

When onions are raised from seed sown where the crop is to mature, the drilling should be done as early as possible in the spring. Too much care cannot be exercised in making the soil loose and fine and free from stones and rubbish which would interfere with drilling and cultivating. Drills are made about half an inch deep and one foot apart. When plants are up, thin to two inches apart. Every other plant may be pulled, bunched and sold in a green state while the remaining plants may be left until maturity if this is considered more profitable.

A common system of culture is to plant sets and raise this vegetable to bunch for the market sometime in June. The ground can then be cleared and planted with a second crop, as celery. If preferred, mature bulbs may be grown from the sets and this method will insure success in almost any soil which is properly manured and cultivated.

Another plan followed to a considerable extent in recent years, is to sow seeds of the large Spanish or Italian varieties, as Prizetaker and Victoria, in the greenhouse or hotbed and then transplant into the field at the earliest possible date. At least six weeks are required to make strong, thrifty plants. This method is fully described in Farmers' Bulletin No. 39.

A favorite plan with many gardeners is to plant sets in the fall of such varieties as the Egyptian and Multipliers. This method insures a crop of green onions for bunching at the earliest possible date. The three most extensively grown of American onions produced from seed sown in the field are Yellow Danvers, Silver Skin and Red Weathersfield.

PARSLEY.

This vegetable is not extensively grown except in the vicinity of large cities. It is used for garnishing purposes as well as in soups, stews and other dishes. It may be grown under the greenhouse bench and also in the garden. Space near the walks under the greenhouse benches can often be utlized to good advantage in growing this crop. The plants may be started out of doors in boxes six inches deep and then place these boxes under the benches when forcing operations begin in the fall.

For the garden crop, maturity is hastened by sowing seed under glass and transplanting once before setting in the field or garden. When sown in the open air, drillings may be made in the spring as soon as the ground can be put in order. The soil should be fine and mellow. Sow in drills one-half inch deep and a foot apart. When plants are large enough, thin, leaving them five or six inches apart.

Another practice is to sow in the garden early in September, placing leaves or other loose litter between the plants late in the

fall to afford protection through the winter. The most popular varieties are Dwarf Perfection, Early Curled Dwarf and Dark Moss Curled.

PARSNIP.

The parsnip thrives best in rich, moist, sandy soils although it may be grown to perfection in any deep soil of a distinctly loamy nature. The soil must be kept loose by the addition of liberal amounts of vegetable matter Whatever manure is used should be thoroughly decayed. Preparation of the ground, whether by spading or plowing, should be as deep as the soil will permit.

For the best results the seed should be drilled one-half inch deep, or slightly deeper, in rows one foot apart. Drill as early in the spring as the soil can be prepared and thin, leaving plants five or six inches apart. If to be cultivated with a horse, the rows should be not less than two feet apart. For thin soils the Early Round French will give the finest roots, while for deep soils it would be better to plant Improved Guernsey, Improved Half-Long, Hollow Crown or Long Smooth.

The parsnip is improved by frost and a portion of the crop is frequently left in the ground all winter. When wanted to sell during the winter the roots may be stored in a cool, dry cellar and covered with sand to exclude air and thus prevent drying out.

PEAS.

To produce any considerable quantity of peas, large plats must be planted, and for this reason it is considered a better crop for farmers than for market gardeners who do not usually cultivate extensive areas. Peas may be grown on any good soil, although light, well drained loams produce the earliest crops. Moderate fertility is required and the soil may be enriched by the use of partially decayed manure and high grade fertilizers. It is important to plant the early varieties the first day the ground is dry enough. Thirty inches between the rows is sufficient space for dwarf varieties while the tall varieties must have from three to five feet. Early peas need not be covered with more than an inch of soil, while the late varieties and later plantings when the ground is drier, should be covered with two or three inches of soil.

Supports are not generally used in large plantations and to obviate this troublesome work the dwarf varieties are the most popular. When supports are necessary, brush serves the best purpose, although poultry netting presents a much neater appearance.

As dwarf extra early varieties, American Wonder and Nott's Excelsior are among the best. These grow about fourteen inches high. Alaska is a second early variety, growing about two feet high. Advancer and Abundance are standard medium early varieties. For the main crop or later varieties, may be suggested American Champion and Reliance. For a sugar or edible podded, Melting Sugar gives excellent results.

PEPPER.

This vegetable is grown much more extensively than even a few years ago and it has become a profitable crop of the market garden. The mild, sweet varieties are particularly in demand. Peppers and

egg plants require about the same conditions of soil and temperature as tomatoes, and soil where tomatoes succeed well will generally produce good peppers. Warm, sandy or gravelly loam soils are best adapted to the growth of this vegetable. The market gardener should aim to produce peppers as early as possible because the early crop is the most profitable. They require transplanting once, and twice is better in the hotbed or greenhouse, before setting in the field. Fertilize the ground as for tomatoes and plant in rows twenty-eight inchese apart and eighteen inches apart in the rows. The most popular and largely grown, mild-flavored varieties used for slicing or stuffing are Bull Nose, Sweet Mountain, Ruby King and Chinese Giant. Neapolitan is a new variety of special merit. The Long Red Cayenne is the standard hot pepper of commerce.

SWEET POTATOES.

This crop is not grown to any considerable extent in our State. It requires a light, sandy soil, a warm climate and a long season. Anyone especially interested in its culture can get information by applying to the New Jersey Experiment Station or to the United States Department of Agriculture.

RADISH.

For large, commercial plantations, sandy soils should be selected, particularly for varieties with long roots like the Long Scarlet Short Top. The turnip and olive-shaped types may be successfully grown in any good, light sandy soil, but all varieties produce the finest radishes in sandy soils. The soil must be rich, mellow and retentive of moisture. Large applications of rotten manure, and frequent tillage are necessary to control moisture conditions.

Radish seeds are nearly always sown too thick and the result is poorly developed roots. The drill should be carefully adjusted and then thin when necessary. Sowings should be made at intervals of ten days to afford a succession. For the winter crop, sowings should be made early in September.

There are so many different varieties of radishes that it is impossible to decide which are best for different soils and which will best meet the requirements of the different markets of the State. The following are popular and largely grown:

Early round or turnip-shaped varieties: Hailstone, Scarlet Globe, White Turnip and Early Round Dark Red.

Olive-shaped varieties: French Breakfast, Burpee's Earliest White and Half-Long Deep Scarlet.

Early long varieties: Early Scarlet Short Top and Long White Vienna.

Summer and autumn varieties: Chartiers and Long White Vienna.

Winter varieties: White Chinese and Chinese Rose.

RHUBARB.

This vegetable is easily cultivated and is a splendid crop for the general farmer's market garden. It thrives best in a light, open, porous soil but does well in any soil properly enriched by the use of manure and fertilizer. Very liberal quantities of manure may be worked into the soil, and half a pound of bone meal, mixed in each

hill before planting, will induce rapid growth. A high grade complete fertilizer should be applied broadcast.

Rhubarb roots may be bought of seedsmen or other dealers and this is the most practical plan if only a limited number of plants are required. For large plantations it is more economical to raise the plants at home. Any good friable soil may be selected for this purpose. Thoroughly fine the soil before sowing the seed. Drill one-fourth inch deep in rows one foot apart. If the soil is not naturally very fine, make furrows with a hoe, sow seed by hand and cover with one-fourth inch of finely sifted soil. Firm the drills by rolling or better by the use of the feet. The seeds should be sown in the spring as soon as the ground can be prepared. Cultivate frequently with a wheel hoe and destroy all weeds. The roots will be ready for the permanent plantation in the fall or following spring. Rhubarb is planted in the field three by four feet apart and given thorough and frequent cultivation. No cuttings should be made the first year but harvesting may begin the second year from planting. Manure should be applied to the plantation every fall and worked into the soil the following spring. The two most popular varieties are Myatt's Victoria and St. Martin's.

RUTABAGAS OR SWEDES.

This vegetable requires about the same condition of soil as the turnip. If to be worked with a hand wheel hoe the drills should be about fifteen inches apart and plants thinned to six inchese apart. If there is a market for the vegetable, it can be planted to advantage as a second crop, following peas, potatoes or other early vegetables. Rutabagas should be stored away before there is danger of hard frosts. Monarch Improved Purple Top and Golden Heart are the most popular varieties.

SALSIFY.

Salsify or oyster plant is one of the most delicious of vegetables and is not grown as largely as its merits demand, either in the home garden or for commercial purposes.

The seed should be sown as early in the spring as the ground can be prepared, making drills one foot apart and covering seed with about one inch of soil. When the plants are large enough to facilitate rapid and careful handling, thin, leaving a plant every five or six inches. Salsify does best in a deep,rich, sandy soil, although it may be grown successfully in any kind of a deep, fertile garden loam. Fresh manures should not be used for this vegetable as it induces the formation of too many fibrous, lateral roots. Bone meal and the mineral elements can be used with good effect. Favorable conditions for the growth of salsify are furnished by liberal manuring the previous season for cabbage and other vegetables requiring high feeding. The crop may be dug in the fall and stored in the cellar and covered with sand, or the roots may be left in the ground until spring. Market gardeners usually store the bulk of the crop so sales can be made during the winter. The roots are entirely hardy, however, and there will be no loss if left in the ground. Sandwich Island Mammoth is the leading variety.

SPINACH.

Spinach is a most delicious vegetable, the cultivation of which is not so extensive as it should be. It is grown for consumption in the spring and early summer and also for use late in the fall.

For the best and most rapid growth of this vegetable the soil should be moist and rich. Manure should be used liberally and commercial fertilizers may be used freely. The seeds are usually sown one inch deep in drills one foot apart. For early maturity, sowings should be made as soon as possible in the spring, cultivating frequently. For autumn use, sowings should be made about September 1st. If desired, the plants can be held through the winter by mulching with leaves or other light material and the crop harvested in the spring. The Prickly or winter varieties must be planted for this purpose. Victoria and Long Standing Prickly, are desirable varieties for spring planting.

SQUASH.

The squash is grown in the same manner as watermelons and requires about the same conditions of soil as the cucumber. The ground should be loose and rich and it is difficult to apply too much rotten manure. Hills should be seven to eight feet apart each way. The old Hubbard is generally grown for winter use and none of the newer varieties are superior to it. Summer squashes find ready sale on some markets and they are very easily grown.

TOMATO.

The writer has found the tomato one of the most profitable garden crops. It is better adapted to the farm garden, where land is of moderate value, than to locations in close proximity to city markets where the land is high priced. When grown for the markets rather than for canneries, it is exceedingly important to reach the market at the earliest possible date. Great advancement has been made in the earliness as well as the quality of early varieties and it behooves the specialist to make annual tests of all promising new varieties so they can be planted largely the following year if found more valuable than older varieties.

The reader should refer to chapters on the use of hotbeds, cold frames and greenhouses for details concerning the starting or raising of the plants and it is only necessaray to give a few notes here which apply directly to the tomato.

For the earliest crop, the seed should be sown in the hotbed or greenhouse not later than the middle of February. This allows plenty of time for two transplantings before setting in the field or garden. Although the tomato demands a high temperature, it is important to regulate the growth by judicious watering and careful ventilation. An abnormally high temperature and excessive amounts of water tend to produce weak, spindling plants. A day temperature of 65 or 70 degrees is about right for growing tomato plants, while a much higher temperature with sunshine will do no harm. If the seed is sown the 15th of February, the first transplanting should be made about the 15th of March. At the first transplanting we use the bench of the greenhouse or hotbed, making check rows one and one-half inches apart. In three or four weeks

the plants are shifted again, allowing five to six inches between plants when we want to secure the best and the strongest plants. We grow a considerable number each year in soiled or discarded berry baskets, and also some in pots, as shown in Fig. 9. Plants of the quality shown in the pot will produce ripe tomatoes in small quantity by the 4th of July. A berry basket is just as good and perhaps better than a pot as there is less tendency of the roots to knit in a compact mass about the sides of the basket. When grown in berry baskets the thin wood is removed in the field just before setting the plant, and if the box is not too badly decayed, it is saved for the following year. By this method the plants are set without wilting or checking growth in the slightest degree. The essentials in growing real early tomatoes are, to select a first early variety such as Earliana or June Pink, grow a large stocky plant carrying a cluster or two of blossoms and perhaps a few small green tomatoes, set in the field after danger of frost, transplant without checking growth and feed and give careful attention in the way of hoeing and cultivation.

Very satisfactory results may be secured by setting plants at the second transplanting directly into the soil of the hotbed, allowing from four to six inches between plants. Of course, the more space given the plants in the hotbed the more favorable the conditions are for the development of large, stocky plants. The objection in allowing so much space is that too much glass is required to raise plants for even a limited area. Three by three feet apart is the most common distance to plant early varieties in the field and this requires about 4,800 plants per acre. If the plants are set 6 x 6 inches in the hotbed, one sash will cover only 72 plants and 66 sash will be needed to raise enough plants for an acre. This is rather expensive and yet many gardeners make it pay. When planting 4 x 4 we get 172 plants per sash, thus enabling us to plant so much larger area in the field. The bulk of our plants are set 4 x 4 in flats. These flats are set in the cold frames after the early cabbage has been planted in the field. When ready to plant tomatoes in the field the flats are hauled and distributed over the ground, and each plant is removed with a large block of compost attached to the roots. The plants will not wilt seriously and watering after transplanting is never necessary.

The tomato thrives in almost any kind of soil which has been properly fertilized, but it prefers sandy or gravelly loams. The soil must not be excessively rich in nitrogen as this causes too much growth of vines and leaves at the expense of fruit. Enough nitrogen should be used to get sufficient plant growth and the mineral elements used freely for the development of the fruit. See fertilizer table on page 53.

It is an advantage to plant in check rows in the field so the cultivator may be run both ways. In field culture it is best to broadcast about three-fourths of the fertilizer and use the balance in the hill. Our own practice is to broadcast about 1,000 pounds per acre and then use about 500 pounds of fine bone meal in the hills. If the plants do not grow rapidly enough early in the season, top dressings of nitrate of soda may be made with splendid results. A teaspoonful around each plant makes a good dressing. The nitrate will forward the plants before the soil is sufficiently warm to favor rapid

FIG. 9.—Early tomato plant in four inch pot.

growth. Late tomatoes should not be planted closer than four feet apart each way and a greater distance is desirable in very rich soils.

For general field culture, we do not practice or advocate the nipping or pruning of plants in any way. There is a tendency, however, among some tomato growers in our State to train plants to single stems. Training in this way hastens the maturity of the bulk of the crop, increases the percentage of smooth, first grade specimens and reduces the percentage of rot. It is particularly valuable in encouraging earliness which is the main purpose of the system. When plants are trained to single stems, the rows need not be more than three feet apart and the plants eighteen inches apart in the rows. An early maturing variety, as Earliana, should be selected for this purpose although later tomatoes of better quality, as Matchless and Trucker's Favorite, should be planted when quality rather than earliness is the chief end. In training to single stems, all side shoots or branches are pinched off with the thumb and finger, attending to the work once a week. When the plants are about four feet high further growth is prevented by nipping the top. The plants are supported by light stakes, tying at three or four points with coarse twine. This system of tomato growing is particularly desirable for the home garden.

There are so many excellent varieties of tomatoes that it is difficult to decide what to plant, or recommend to others for commercial planting. For the earliest cropping there is probably nothing better than Earliana. The fruits of this variety do not possess the smoothness, solidity and quality of later varieties, but as a money maker it cannot be surpassed. It is profitable because it is extremely early and very prolific. Anyone attempting to grow this variety should make every effort to have the fruit on the market as early as possible. Chalk's Early Jewel is a favorite variety which is grown extensively on our farm. It is at least a week later than Earliana but is much smoother and more desirable in every way except from the standpoint of earliness. Matchless is a splendid tomato to follow Chalk's Early Jewel. It is a vigorous grower and produces large, smooth, solid tomatoes of fine quality. For red tomatoes the foregoing make a fine combination. Ealiest Pink, Fordhook First, June Pink and Globe are desirable early pink tomatoes, while there is nothing better than Trucker's Favorite as a late pink tomato. Acme, Stone, Perfection, Beauty, Success, Freedom and many other excellent sorts are grown by market gardeners.

TURNIP.

The turnip delights in a rich, loamy soil. For early use the seed should be sown as soon as the ground can be prepared. Although turnips are frequently sown broadcast, good results are more certain by drilling one-half inch deep in rows one foot apart. The plants should be thinned, leaving them about three inches apart. For a succession, sowings should be made about every two weeks until the proper time to sow for the late crop. Thorough tillage is necessary for the largest yield. The following varieties are extensively grown: Early Red or Purple Top Strap Leaved, Early Top Milan, White Egg, Scarlet Kashmyr, Purple Top White Globe and the Long White or Cowhorn.

NUMBER OF PLANTS REQUIRED PER ACRE AT VARIOUS DISTANCES.

1 in. x 10 in.—627,269.	18 in. x 2 ft.— 14,520.
1 in. x 12 in.—522,720.	18 in. x 30 in.— 11,616.
2 in. x 10 in.—313,632.	18 in. x 3 ft.— 9,680.
2 in. x 12 in.—261,360.	18 in. x 4 ft.— 7,260.
3 in. x 12 in.—174,240.	18 in. x 5 ft.— 5,804.
4 in. x 12 in.—130,680.	2 ft. x 2 ft.— 10,890.
6 in. x 12 in.— 87,120.	2 ft. x 3 ft.— 7,260.
12 in. x 12 in.— 43,560.	2 ft. x 4 ft.— 5,445.
12 in. x 15 in.— 34,848.	2 ft. x 5 ft.— 4,356.
12 in. x 18 in.— 29,040.	3 ft. x 3 ft.— 4,840.
12 in. x 24 in.— 21,780.	3 ft. x 4 ft.— 3,630.
12 in. x 30 in.— 17,424.	3 ft. x 5 ft.— 2,904.
12 in. x 3 ft.— 14,520.	4 ft. x 4 ft.— 2,722.
12 in. x 4 ft.— 10,890.	4 ft. x 5 ft.— 2,178.
12 in. x 5 ft.— 8,712.	5 ft. x 5 ft.— 1,742.
15 in. x 18 in.— 23,232.	5 ft. x 6 ft.— 1,452.
15 in. x 2 ft.— 17,424.	6 ft. x 6 ft.— 1,210.
15 in. x 3 ft.— 11,619.	6 ft. x 7 ft.— 1,037.
15 in. x 4 ft.— 8,712.	6 ft. x 8 ft.— 907.
15 in. x 5 ft.— 6,969.	7 ft. x 7 ft.— 888.
18 in. x 20 in.— 17,424.	8 ft. x 8 ft.— 680.

QUANTITY OF SEED REQUIRED PER ACRE.

Asparagus, $2\frac{1}{2}$ ounces to 100 feet of drill; 2 pounds should produce enough roots to plant an acre.

Beans, dwarf, 1 quart to 100 feet of drill; $1\frac{1}{4}$ bushels per acre. Lima, $\frac{3}{4}$ bushel to an acre. Pole, 1 pint to 100 feet drill; $\frac{1}{2}$ bushel per acre.

Beet, 1 ounce to 50 feet of drill; 4 pounds to an acre.

Broccoli, 1 ounce to 300 feet of drill; 2 ounces per acre.

Cabbage, 1 ounce to 300 feet of drill; hotbed or greenhouse 1 ounce should produce at least 2,000 plants; outdoors, 1 pound should produce at least 20,000 plants.

Carrot, 1 ounce to 100 feet of drill; $2\frac{1}{2}$ pounds to an acre.

Cauliflower, 1 ounce should produce 3,000 or more plants.

Celery, 1-3 ounce to 100 feet of drill; 1 ounce should produce at least 10,000 plants.

Sweet Corn, $\frac{1}{4}$ to $\frac{1}{2}$ pint to 100 hills; when planted in hills 1 peck to an acre.

Cucumbers, 1 to 2 ounces to 100 hills; 1 to 2 pounds to an acre.

Egg Plant, 1 ounce should produce 1,500 to 2,000 plants.

Endive, $\frac{1}{4}$ ounce to 100 feet of drill; $4\frac{1}{2}$ pounds per acre.

Kale, 1 ounce to 300 feet of drill.

Kohl-rabi, 1 ounce to 300 feet of drill; 4 pounds per acre.

Leek, 1 ounce to 100 feet of drill; 4 pounds per acre.

Lettuce, $\frac{1}{4}$ ounce to 100 feet of drill; 3 pounds to an acre.

Melons, musk, 2 ounces to 100 hills; 4 x 4 feet, 2 pounds to an acre.

Onion, seed, $\frac{1}{2}$ ounce to 100 feet of drill; 4 to 5 pounds per acre. Sets, 1 quart to 40 feet of drill; 8 bushels, and more, if large, per acre.

Parsley, $\frac{1}{2}$ ounce to 100 feet of drill; 3 pounds to an acre.

Peas, 1 to 2 pints to 100 feet of drill; $1\frac{1}{2}$ to $2\frac{1}{2}$ bushels per acre.

Pepper, 1 ounce should produce 1,500 plants.

Radish, 1 ounce to 100 feet of drill; 10 to 12 pounds per acre.

Rhubarb, 1 ounce of seed to 125 feet of drill; 3½ pounds to an acre.

Salsify, 1 ounce of seed to 100 feet of drill; 8 pounds to an acre.

Spinach, 1 ounce to 100 feet of drill; 8 pounds to an acre; broadcast, 30 pounds to an acre.

Squash, summer, 4 ounces to 100 hills. Fall and winter, 8 ounces to 100 hills.

Tomato, 1 ounce of seed should produce 3,000 to 4,000 plants.

Turnip, 1 ounce to 200 feet of drill; 1 to 2 pounds to an acre.

AVERAGE COMPOSITION OF DIFFERENT VEGETABLES AND THEIR FERTILIZING VALUE.

	Pounds of nitrogen in one ton.	Pounds of phosphoric acid in one ton.	Pounds of potash in one ton.	Approximate fertilizing value of one ton.
Asparagus,	6.0	1.6	6.0	$0 90
Beets,	5.0	2.0	9.0	95
Cabbages,	7.6	2.2	9.0	1 20
Carrots,	3.2	2.0	10.0	80
Cauliflower,	2.6	3.2	7.2	70
Celery,	4.8	4.4	15.0	1 25
Cucumbers,	3.2	2.4	4.8	65
Horseradish roots,	8.0	2.0	20.0	1 70
Lettuce,	4.6	1.4	7.4	80
Onions,	4.0	2.5	3.5	65
Peas,	23.0	6.0	8.5	2 90
Pumpkins,	2.2	3.2	2.0	45
Rhubarb,	2.6	0.4	7.2	55
Spinach,	10.0	3.2	5.4	1 35
Sweet corn, cobs,	4.2	1.0	4.4	65
Sweet corn, husks,	3.6	1.4	4.4	60
Sweet corn, kernels,	9.2	1.4	4.8	1 15
Sweet corn, stalks,	5.6	2.8	8.2	1 00
Sweet potatoes,	4.8	2.0	10.0	95
Tomatoes, fruit,	3.2	1.0	5.4	60
Tomatoes, vines,	6.4	1.4	10.0	1 10

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